Impact of Road Transport Industry Liberalization in West Africa

Final Report

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**Glossary**

- **ASYCUDA**: Automated Systems for Customs Data
- **CAF**: Cost, insurance, freight
- **CCIAD**: Chambre de Commerce d’Industrie et d’Agriculture de Dakar
- **CCIM**: Chambre de Commerce et de l’Industrie du Mali
- **CEDEAO**: Communauté Economique de l’Afrique de l’Ouest (ECOWAS in English)
- **CGE**: Computable general equilibrium (model)
- **CNUT**: Nigerien Council of Users of Land Transport
- **DT/DTT**: Directorate of Transportation/Department of Land Transport (Niger)
- **ECOWAS**: Economic Community of West African Countries (CEDEAO in French)
- **EDI**: Electronic data interchange
- **FCFA**: Franc currency of the Communauté Financière d'Afrique
- **FIFO**: First in, first out
- **GT**: Gross tonnage
- **HDM4**: Highway Development and Management software
- **ICT**: Intermodal container terminal
- **INCÔTERM**: International commercial terms for imports and exports
- **IRTG**: Improved Road Transport Governance Program
- **JAPTU**: Joint Association of Port Transport Unions
- **km/h**: Kilometers per hour
- **SAD**: Single administrative document
- **SSATP**: Sub-Saharan Africa Transport Program
- **TCBoost**: Worldwide Support for Trade Capacity Building
- **TEU**: Twenty-foot equivalent unit (for containers)
- **TIE**: Interstate Road Transport Convention
- **ton**: Metric ton
- **TRIE**: Convention on Interstate Transport of Goods by Road
- **UEMOA**: Union Economique et Monétaire Ouest Africaine (WAEMU in English)
- **UNTR**: Union National des Transporteurs Routiers
- **USAID**: United States Agency for International Development
- **US$$**: Dollar currency of the United States of America
- **WA**: West Africa
- **WCO SAFE**: World Customs Organization Framework of Standards to Secure and Facilitate Global Trade
- **WAEMU**: West African Economic and Monetary Union (UEMOA in French)
Abstract

This report summarizes the situation of the West African trucking industry and describes a model for calculating the impact of reform on the industry and the regional economy. It traces this impact for eight countries and a variety of stakeholders including truckers, shippers, governments, producers, and consumers. Total net economic benefits on the order of US$400-500 million could be expected from industry reforms, about one-third of which would be attributable to reducing truck overloading and the rest to other reforms. Transit trade could increase on the order of 8 percent in value as a result of reform.

The model described in this report was supported by field research in Niger and Benin, but more research is needed in other countries to refine the model for more accurate predictions.
Executive Summary

Many analysts characterize the West African trucking industry as high-priced, inefficient, dominated by informal sector operators, and saddled with regulations that worsen inefficiencies and encourage behavior that further raises prices. National governments, regional economic organizations, USAID, the World Bank, and other donors are seeking to analyze the impact of these characteristics on the economy and communicate to stakeholders the benefits of reform.1

In this report we describe the situation of the West African trucking industry, focusing on eight countries with substantial transit traffic: Benin, Burkina Faso, Côte d’Ivoire, Ghana, Mali, Niger, Senegal, and Togo. Additional field research on the trucking industry was carried out in Niger and Benin. We developed a preliminary model to quantify the impact of potential reforms on the trucking industry for a range of stakeholders in these countries, drawing on information available at the time and a wide range of research reports. This model is somewhat approximate in its current state, but it is sufficient for estimating the order of magnitude of the expected impacts and the size of the trade-offs among stakeholders.

Two scenarios were explored with the preliminary model to define the maximum benefit and cost of a package of reforms, including axle load controls, elimination of quotas, queuing and the ban on freight transport in one country by truckers from another country, subsidies for truck fleet modernization, and major reductions in en route checkpoints and border transit times. The first scenario assumes that the shares of transit traffic remain the same between coastal and landlocked trucking fleets, while the second scenario examines shifts in those shares to lower cost operators. Both scenarios assume that axle load controls reduce overloading of transit trucks by 97 percent.2

The net benefit to the regional economy from these reforms is estimated at US$400–US$500 million per year, one-third of which would be attributable to axle load controls and the rest to other reforms. Governments could be expected to save US$200-US$300 million in road maintenance, while the trucking industry (and especially the number of informal operators) would shrink as a result of productivity increases and less waiting time in queues at ports and border posts.

Under these scenarios, transport costs per ton-km are expected to decrease by 20 percent and transport prices by 19 percent. This would create the conditions necessary for an increase in the value of transit trade by about 8 percent. The regional trucking industry would gain about US$60

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1 As part of this effort USAID has funded this study of the Impact Assessment of the Road Transport Industry Liberalization in West Africa with the support of the World Bank as part of the study team.
2 A level achieved in Southern Africa.
million in net revenue, while shippers, producers, and consumers in landlocked countries could gain US$200 million in net economic benefits.

Among stakeholders, the major losers would be the informal sector truckers, who would be expected to lose 16,000 jobs (although many would gain by shifting to the formal sector). According to the model, 150,000 to 650,000 trade-related jobs would be created, substantially more than would be lost in the trucking industry.

There may also be resistance to lower prices for transport by some stakeholders. This can create a critical problem since lower prices are needed to trigger additional trade growth. If transport prices are not allowed to fall under the influence of market pressures, there will be much less influence on trade, although a continuation of past relative modest growth is likely, even with restraints on competition. This scenario would have less benefit for the region and policies should be targeted to avoid it.

There may be a need for a campaign to educate stakeholders about the broader benefits of the reforms related to achieving additional growth and its benefits.

It is recommended that trucking industry reforms be initiated in West Africa as the benefits are clearly much larger than the costs. These reforms should include mechanisms to mitigate the impact on informal sector truckers, such as compensating those bearing the greatest loss and providing job retraining. Further research, particularly on the transit trucking industry in the six countries not included in the field work for this study, is recommended to refine the model.
1. Introduction

The high price of transporting goods in West Africa is a well-known challenge to economic growth and efficiency in the region. In a World Bank study, Terevaninthorn and Raballand (2008) revealed that road transport prices in Africa are on average higher than other regions in the world. This has been confirmed by other studies, including those recently prepared by the West Africa Trade Hub (WA Trade Hub) and the Worldwide Support for Trade Capacity Building (TCBoost) projects. Those studies highlighted how regional and national transport policies and the degradation of corridor infrastructure have contributed to inefficiencies on the Tema-Ouagadougou, Lomé-Ouagadougou, and Ouagadougou-Bamako transport corridors.

National governments, regional economic organizations, USAID, the World Bank, and other donors are seeking to analyze the impact of high transport prices on the economy and communicate to stakeholders the benefits of reforming the road transport industry in West Africa. As part of this effort, USAID funded this reform impact study with the support of the World Bank, which provided expert time to the study team. During a Phase 1 workshop, a preliminary conceptual framework was defined, the kind of data needed to further define the characteristics of the road transport industry and its policy environment in West Africa was identified, and a pilot study to collect data on the trucking industry and its policy environment was planned for the Cotonou-Niamey corridor (Nathan Associates 2011b). The data collection for the pilot study was carried out in December 2011 (Nathan Associates 2012).

This report reflects the results of collaboration between the World Bank, the West Africa Trade Hub, and TCBoost projects to develop a tool for comprehensive impact assessment. The TCBoost team would like to thank the WA Trade Hub and the World Bank team members for their assistance in developing a joint work plan, conceptualizing the impact model, identifying high priority data collection, and identifying issues and constraints.

In this report, we summarize available knowledge on the trucking industry in West Africa (Chapter 2), summarize the findings of the impact assessment study (Chapters 3-6), and present recommendations for impact modeling and full development of a tool for estimating the impact of reforms and changes in the policy environment on the road transport industry and national and regional economies (Chapter 7).

2. Road Transport Industry in West Africa

The road transport industry in West Africa comprises domestic and international trucking and serves 11 international corridors connecting 15 countries (Figure 2-1). The primary transit corridors connecting landlocked countries to coastal ports represent about 10,500 km of paved roads (Table 2-1). The total volume of international trade in these corridors was approximately 11.5 million tons in 2009, including intraregional trade of 6.2 million tons and transit trade for landlocked countries of 5.3 million tons. Parts of these corridors also carry significant amounts of domestic freight traffic.

The transport and trade system in West Africa is monitored by facilitation committees from the two regional economic communities (Union Economique et Monetaire Ouest Africaine and Economic Community of West African States-UEMOA and ECOWAS) linked to national facilitation committees, the USAID/West African Trade Hub, and the UEMOA Transport Observatory. In addition, three corridor management committees were recently formed to monitor transport efficiency in the Tema-Ouagadougou-Bamako Corridor, the Lakaji Corridor (in Nigeria), and the Abidjan-Lagos Corridor.

The road transport sector in West Africa has been described as:

- Higher priced, less efficient, and less reliable that transport in other regions of Africa and the world;
- Dominated by older vehicles and small informal operators; and
- Saddled with policies and regulations that provide no incentives to become more efficient.

In the rest of this chapter we describe the main characteristics of the road transport industry in West Africa and its policy environment, drawing on published research and a field survey carried out for this study in Benin and Niger and for the Cotonou-Niamey corridor (Chapter 5).

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4 Estimates from SOFRECO (2011).
5 See USAIDS Markets (2010).
6 See ALCO et al. (2010).
Figure 2-1
West African Transport Corridors and the Study Area for Past Industry Analysis

Table 2-1
Length of Primary West African Transit Corridors

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>1,053</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>1,225</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>1,148</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>1,694</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>1,967</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>1,030</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>1,576</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>1,973</td>
</tr>
<tr>
<td>Lome-Ouagadougou</td>
<td>986</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>1,222</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>1,200</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>1,031</td>
</tr>
<tr>
<td>Total (without overlaps)</td>
<td>10,451</td>
</tr>
</tbody>
</table>


INDUSTRY STRUCTURE
The road transport industry in West Africa is composed of three general types of truckers:8

- Informal sector common carriers
- Formal sector common carriers
- Own-account carriers.

Each type has different operating practices and mixes of vehicles. Informal sector truckers make up an estimated 90 percent of the international trucking industry in West Africa (Zerelli and Cook 2010, 10), and the industry is dominated by small owner-operators, particularly in the informal sector (Table 2-2).

Table 2-2
Estimated Fleet Composition of Formal and Informal Sector Transit Operators and Domestic Operators in West Africa (excluding Nigeria)

<table>
<thead>
<tr>
<th>Fleet Type</th>
<th>Transit Operators</th>
<th>Domestic Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cote d’Ivoire and Ghana</td>
<td>Other Countries</td>
</tr>
<tr>
<td></td>
<td>Informal (%)</td>
<td>Formal (%)</td>
</tr>
<tr>
<td>Small trucks (3-10 tons)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medium trucks (15-30 tons)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Large trucks (35-40 tons)</td>
<td>98</td>
<td>89</td>
</tr>
<tr>
<td>Very large trucks (45-51 tons)</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

SOURCE: Estimates based on interviews in Niger and Benin.

The trucking industry in Senegal, for example, is composed of a large number of very small operators, who rarely own and operate more than a few trucks, and a half a dozen subsidiaries of large multinational carriers or logistics providers (e.g., Maersk). Except for the fleets owned and operated by multinational companies, the Senegalese trucking fleet is obsolete, and most of the traffic to Mali is carried on Malian trucks (according to some observers, close to 90 percent of all Mali traffic). Mali recently upgraded its trucking fleet and has a large capacity to make the long trip from Dakar to Bamako (Booz Allen Hamilton 2010, 15).

TRUCK FLEETS
All observers of the truck fleets in West Africa characterize them as generally old with a high percentage in bad condition, although the fleets of the formal sector operators are newer and better maintained than the informal sector vehicles. According to Zerelli and Cook, the fleets of

8 Common carriers are truckers who offer transport services for hire to the public. Informal sector operators are traditional small truckers with limited education and training who operate older vehicles using traditional practices of management that rely on extended family workers with a minimum of written records and vehicle overloading, and bribes for officials who condone these operations. Formal sector operators use more modern management techniques and newer vehicles. Own-account operators work for large firms engaged in other economic activities such as import/export, manufacturing, freight forwarding and support these with transport of their own products.
the landlocked countries are generally in worse shape than the fleets in the coastal countries. The
average age of trucks traveling in international corridors is about 13 years, but statistics on the
Niger fleet show a higher age (17 years).  

Côte d’Ivoire and Ghana transit fleets include very large trucks, while these have not yet been
adopted in other countries with smaller GDPs in the region (see Table 2-2). The typical fleet
compositions of transit truckers and domestic truckers are quite different and they also vary with
the category of operator (formal or informal sector).

The heavy goods truck fleet in the Côte d’Ivoire, for example, is estimated at 30,000 vehicles, of
which 40 percent are out of service at any given time and 85 percent are more than 10 years old.
An estimated 70 percent of these vehicles were purchased used and 15 percent were purchased
when they were more than 20 years old. This fleet is composed of about 33% container carriers,
50% conventional trucks with sides, 5 percent tank trucks and 12 percent others (Ballereau et

The heavy goods fleet in Togo is estimated at 4,500 trucks. While 70 percent of trucks in Côte
d’Ivoire were purchased used, 99 percent of the truck fleet in Togo was purchased used.
Consequently, the average age of vehicles is older and their condition worse in Togo, although
the same percentage (15 percent) were purchased when they were more than 20 years old. An
estimated 50 percent of these vehicles were out of service in 2008. Thirty percent of the active
fleet is composed of container carriers, 6 percent tank trucks, and 64 percent conventional trucks.
About 80 percent of the Togolese container carriers and 70 percent of the conventional trucks are
used for international goods transport (World Bank 2010). This percentage used in international
traffic is much higher than in coastal countries with larger economies, such as Ghana and Côte
d’Ivoire.

In Niger the situation is even worse, where a large number of trucks were purchased in the 1980s
and 1990s with very few new purchases in recent years. Only used trucks have been purchased
for registration since 2007. These are primarily from Nigeria or Europe, with the Nigerian trucks
of relatively low quality but less expensive to buy. (See Chapter 5 for more details). Mali, on the
other hand, has a recently renewed fleet, according to Booz Allen Hamilton, so the average age is
much lower than for other countries.

The estimated size of heavy goods fleets in eight West African countries is presented in Table 2-3.
About 20 percent of this fleet is involved in transit traffic, although the percentage varies
dramatically from country to country, with the landlocked countries and Togo having much
higher than average percentages, Benin about average, and other coastal countries (Senegal, Côte
d’Ivoire and Ghana) much lower percentages according to the size of transit demand relative to
domestic demand and the market incentives to carry transit traffic (Table 2-4).

---

9 See Annequin and Eshun (2009) for the Ouagadougou-Tema corridor. The Niger fleet is apparently much
older than most West African country fleets, although the age may be distorted as some older vehicles that
are out of service are not deducted from the statistics, despite a recent change in accounting for active
vehicles.
### Table 2-3
*Estimated Size of Heavy Goods Vehicle Fleets by Type of Vehicle in Selected West African Countries in 2009*

<table>
<thead>
<tr>
<th>Country</th>
<th>Container Carriers</th>
<th>Conventional Trucks</th>
<th>Tank Trucks</th>
<th>Total Heavy Goods Vehicles</th>
<th>Percent Out of Service&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>2,300</td>
<td>5,300</td>
<td>500</td>
<td>8,100</td>
<td>50</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>3,700&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10,900&lt;sup&gt;b&lt;/sup&gt;</td>
<td>900&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15,500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>50</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>10,000</td>
<td>19,000</td>
<td>1,000</td>
<td>30,000</td>
<td>40</td>
</tr>
<tr>
<td>Ghana</td>
<td>6,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>700&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19,700&lt;sup&gt;b&lt;/sup&gt;</td>
<td>40</td>
</tr>
<tr>
<td>Mali</td>
<td>1,900&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9,200&lt;sup&gt;b&lt;/sup&gt;</td>
<td>900&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>40</td>
</tr>
<tr>
<td>Niger</td>
<td>1,400&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6,100&lt;sup&gt;b&lt;/sup&gt;</td>
<td>700</td>
<td>8,200</td>
<td>60</td>
</tr>
<tr>
<td>Senegal</td>
<td>3,800&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7,200&lt;sup&gt;b&lt;/sup&gt;</td>
<td>500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11,500</td>
<td>50</td>
</tr>
<tr>
<td>Togo</td>
<td>1,200</td>
<td>3,050</td>
<td>250</td>
<td>4,500</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>30,300</td>
<td>73,750</td>
<td>5,450</td>
<td>109,500</td>
<td>45</td>
</tr>
</tbody>
</table>

<sup>a</sup> Vehicles in statistics that are out of service but not purged from the statistics.

<sup>b</sup> Estimate based on a ratio of GDP to Côte d’Ivoire GDP, discounted for less containerized transport in the case of landlocked countries. This assumes that the number of domestic trucks is roughly proportional to GDP (numbers to be refined with field research).


### Table 2-4
*Estimated Size of Domestic and International Heavy Goods Fleets in Selected West African Countries in 2009*

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP&lt;sup&gt;a&lt;/sup&gt; (US$ bill)</th>
<th>Domestic Fleet</th>
<th>International Fleet</th>
<th>Total Heavy Goods Vehicles</th>
<th>Percent International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>12.3</td>
<td>6,000</td>
<td>2,100</td>
<td>8,100</td>
<td>25</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>21.5</td>
<td>9,100&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5,600</td>
<td>14,700</td>
<td>38</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>45.0</td>
<td>28,500</td>
<td>1,500</td>
<td>30,000</td>
<td>5</td>
</tr>
<tr>
<td>Ghana</td>
<td>40.6</td>
<td>17,100&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2,600</td>
<td>19,700</td>
<td>13</td>
</tr>
<tr>
<td>Mali</td>
<td>16.0</td>
<td>6,800&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4,600</td>
<td>11,400</td>
<td>44</td>
</tr>
<tr>
<td>Niger</td>
<td>13.4</td>
<td>5,700&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2,500</td>
<td>8,200</td>
<td>30</td>
</tr>
<tr>
<td>Senegal</td>
<td>25.3</td>
<td>10,700&lt;sup&gt;b&lt;/sup&gt;</td>
<td>800</td>
<td>11,500</td>
<td>7</td>
</tr>
<tr>
<td>Togo</td>
<td>5.0</td>
<td>1,800</td>
<td>2,700</td>
<td>4,500</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>179.1</td>
<td>85,700</td>
<td>22,400</td>
<td>109,100</td>
<td>20</td>
</tr>
</tbody>
</table>

<sup>a</sup> From SOFRECO and NATHAN ASSOCIATES (2011), based on World Bank data, in purchasing power parity terms.

<sup>b</sup> Estimate based on a ratio of GDP to Côte d’Ivoire GDP. This assumes that the number of domestic trucks is roughly proportional to GDP (numbers to be refined with field research).

*SOURCE:* Estimates based on Table 2-2 and Table D-1 (Appendix D), increased to include fleet travelling on transit corridors not listed in Table D-1.
Annual Mileage of Trucks
The number of truck kilometers traveled per year in West Africa is very low compared with other countries in Africa, especially Southern Africa where productivity in the trucking industry is approaching European levels. Low mileage is due to a number of factors, including delays and waiting times at ports and en route, high down time for repairs, and quotas and queuing regulations. Demand seasonality also leaves the fleet underused in off-peak periods. There are also indications that there is overcapacity in truck fleets and this would also lower annual mileage.10

As shown in Table 2-5, the average annual mileage of heavy goods vehicles varies substantially among countries. The majority of trucks in informal sector transit trade is very old and only achieves 50 percent of the average mileage (Ballereau and Douabi 2010, 39). On the other hand, formal sector truckers can achieve 50-70 percent more than the average mileage.

Table 2-5
Average Annual Mileage of Heavy Goods Vehicles in Selected African Countries

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Average Annual Km</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>International</td>
<td>Domestic</td>
</tr>
<tr>
<td>Benin</td>
<td>90,000</td>
<td>65,000 a</td>
</tr>
<tr>
<td>Benin</td>
<td>50,000</td>
<td>65,000 a</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>60,000</td>
<td>80,000 a</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Ghana</td>
<td>45,000</td>
<td>65,000 a</td>
</tr>
<tr>
<td>Mali</td>
<td>30-45,000 b</td>
<td>50-65,000 b</td>
</tr>
<tr>
<td>Niger</td>
<td>15-35,000 b</td>
<td>25-55,000 b</td>
</tr>
<tr>
<td>Niger</td>
<td>30,000</td>
<td>45,000 a</td>
</tr>
<tr>
<td>Niger</td>
<td>45,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Niger</td>
<td>37,500 b</td>
<td>45,000 a</td>
</tr>
<tr>
<td>Togo</td>
<td>60,000</td>
<td>45,000 a</td>
</tr>
<tr>
<td>Togo</td>
<td>60,000</td>
<td>45,000 a</td>
</tr>
<tr>
<td>West Africa</td>
<td>30-90,000</td>
<td>50-90,000</td>
</tr>
</tbody>
</table>

a Estimate based on higher potential for domestic transport with fewer delays in larger countries, but lower potential in smaller countries.

b Mileage for informal sector operators is generally lower than for formal sector operators.

The Côte d’Ivoire truckers appear to have a larger formal sector that achieves high productivity in the domestic market and they do not favor the transit trade. Benin, on the other hand, benefits

10 Several observers make this comment, although Zerelli and Cook (2010) challenge this view, especially in peak seasons.
from proximity to the Nigerian market and associated cross-border trade, which allows higher mileage for its fleet despite the small size of the country.

**BUSINESS PRACTICES**

The business practices of the road transport industry vary somewhat between the three general types of truckers (formal common carrier, informal common carrier, own-account carriers) and there is also some variation within each group. The following business practices are examined below:

- Cultural factors
- Acquisition of modern vehicles
- Maintenance of vehicles
- Overloading
- Informal payments

**Cultural Factors**

Significant cultural factors affect business practices, particularly differences between informal truckers and formal sector truckers. Informal sector truckers are largely owner-operators with one or a few trucks. The formal sector will have a more established management structure and can manage a fleet of vehicles. Drivers in the formal sector are better paid and more literate (and usually get social security benefits), while those in the informal sector are less literate and may depend on family or tribal connections to get hired, although there is a range of qualifications in the informal sector.

Owner-operators tend to be very independent and may come from minority tribes (such as the Dioula in Burkina Faso, Mali, and Côte d’Ivoire) who have a tradition of working as entrepreneurs and traveling long distances. They will have their own support networks that are generally not linked. Informal operators are also more likely to use personal relationships and informal payments to solve problems.

The informal sector owner-operators have a view of their cost structure that does not fully account for the depreciation cost of the vehicles, and relies more on out-of-pocket expenditures to calculate if they are making a profit or not (see Zerelli and Cook 2010, and SITRASS 2007). They have a shorter time horizon in their planning than formal sector operators.

**Acquisition of Modern Vehicles**

The acquisition of modern vehicles is a major issue, particularly for the informal sector and in the landlocked countries. Raising capital and getting loans is difficult. Formal sector operators will be able to deal with banks, but informal ones will usually rely on a wealthy relative to finance a

---

11 They also have become involved involuntarily in the conflict in the Cote d’Ivoire; see [http://www.unhcr.org/refworld/pdfid/4c931ddf2.pdf](http://www.unhcr.org/refworld/pdfid/4c931ddf2.pdf) for more information.

12 There are also come smuggling cultures, particularly groups of people, including traders and truckers in the countries surrounding Nigeria, such as Benin. This is one version of entrepreneurial spirit in the region.

13 Prevailing interest rates in West Africa are very high (e.g., more than 20 percent cited by Terevaninthorn and Raballand).
vehicle. This, along with a short planning horizon is why there is a premium for the informal sector to purchase older, used vehicles. Formal sector operators, on the other hand, are usually capable of providing a business plan and applying for a loan, if necessary, to purchase a modern vehicle.

**Maintenance of Vehicles**
Vehicle maintenance varies according to the type of operator and is a function of the age of the vehicle. The formal sector with newer vehicles will have lower maintenance costs and fewer repairs than the informal sector. Maintenance personnel working in the informal sector will frequently have a family affiliation with the owner and are paid less than formal sector maintenance personnel on average. (See discussion of employment in Appendix D for more detail.)

**Overloading**
Overloading is widespread in West Africa, and many trucks are reinforced so they can carry excessive loads. This, in turn, significantly increases the tare weight of the trucks and severely limits the weight of cargo that can be legally carried for the operators to meet the gross axle-weight limits. Truckers believe that overloading is the only way to make a profit given the prevailing tariff rates.

The current percentage of overloading in different countries is uncertain. The practice varies with the existence of and enforcement of axle load controls (see discussion of enforcement below). In some cases informal payments are used to bypass enforcement, despite programs to encourage enforcement. Surveys in Ghana and Senegal indicate that in 2010 most trucks in transit corridors were overloaded in one direction, but not on backhauls. In Senegal a measurement of 31 percent overloading on the main transit corridor to Mali in 2005 (Nordengen et al, 2006) indicates that 30 percent to 60 percent of trucks carrying imports for Mali could have been overloaded prior to axle load controls in 2011.

In Ghana measurement of axle loads shows variation by month, with a low of 3 percent in February 2006 and a high of 57 percent in October 2007, but declining somewhat since 2007, with an average of 15 percent for 2009 (high of 49 percent in May 2009) (Vision Consult Limited 2011). This could mean an average of up to 30 percent overloading in one direction with much higher percentages in certain months.

**Other Commissions, Bribes, and Informal Payments**
Profit margins for truckers also suffer because they often must pay

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14 See Terevaninthorn and Raballand (2008), SITRASS (2007), and Zerelli and Cook (2010). The calculation of vehicle operating costs for the two types of operators confirms this.
15 See Booz Allen Hamilton (2010), Appendix B. SITRASS (2007) also notes that in Niger and neighboring countries a truck with legal capacity given by the builder of 25 tons is frequently listed in its license (carte grise) at 30 or 32 tons and is overloaded commonly to 35 tons or more. Six-axle articulated trucks can have a legal capacity of 40-44 tons in the CEE and be rated as 51 tons capacity in ECOWAS countries.
• Commissions to freight brokers in the port in order to find freight quickly;
• Informal payments to truckers’ associations to jump queuing mechanism at the ports;
• Bribes to various officials along the route to Sahelian destinations who do not respect permissions granted at the port; and
• Informal payments in the Sahel countries to get permission to carry a southbound load into a coastal country from a landlocked country.

There is a trade-off between, on the one hand, paying fees for illegal services and, on the other, waiting—sometimes for weeks—to get cargo and increase the use of trucking capital. In general, informal sector transporters find themselves making these payments more often than formal sector transporters because they have less negotiating power.

REGULATORY POLICIES AND ENFORCEMENT

Regulatory policies play a role in keeping transport prices high in West Africa and, in combination with the “coalition of interest groups against change” in this region cited by Terevaninthorn and Raballand (2008), greatly reduce the potential effectiveness of other measures that would reduce vehicle operating costs but not transport prices. Therefore changes in policies and enforcement will be critical in reducing prices.

Seven types of policies and regulations affect the efficiency of road transport in West Africa (and depress trade as a result):16

1. Freight sharing rules
2. Queuing systems
3. Third country rule, cabotage, and backhaul regulations
4. Axle load limits
5. Border crossings
6. Roadblocks and checkpoints
7. Transit agreements.

Freight Sharing Rules

The ECOWAS Inter-State Road Transportation Convention (No. A/P2/82) allows pairs of member states to conclude bilateral treaties that set quotas in terms of specific percentages of the freight passing through a coastal country’s port *en route* to a landlocked country to the truckers of each of the two countries. Several such bilateral treaties exist, usually dividing imported goods into “strategic” goods and nonstrategic goods.17 Strategic goods are 100 percent allocated to the landlocked country and nonstrategic goods are allocated 2/3 to the landlocked country and 1/3 to the coastal country.

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16 Vehicle licensing is another form of potential inefficiency, but it has not been found to restrict access in West Africa. (See Terevaninthorn and Raballand, 2008, page 47)

17 The definition of strategic goods varies by landlocked country and can be very arbitrary, for example including construction materials in some cases.
These treaties attempt to avoid perceived threats to national trucking industries by explicitly allocating freight shares for international trucking. In doing so they undermine free markets and the efficiency that accompanies them.18

Such freight sharing rules are not applied systematically to truckers in all markets and for all products. Where they are applied, they are implemented by the Shippers’ Councils in the port for imports. The variation in the impact of these rules on truckers in West Africa is presented in Table 2-6.

**Table 2-6**

*Application of Freight Sharing Rule for Transit Traffic Loaded in West African Ports (nonstrategic cargo)*

<table>
<thead>
<tr>
<th>Location</th>
<th>For All Products and Seasons</th>
<th>For Some Products</th>
<th>For Some Seasons</th>
<th>Not at All</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidjan</td>
<td>29%</td>
<td></td>
<td></td>
<td>71%</td>
<td>100%</td>
</tr>
<tr>
<td>Tema</td>
<td>100%</td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Lomé</td>
<td>42%</td>
<td>29%</td>
<td></td>
<td>29%</td>
<td>100%</td>
</tr>
<tr>
<td>Cotonou</td>
<td>78%</td>
<td></td>
<td></td>
<td>22%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>37%</td>
<td>7%</td>
<td>7%</td>
<td>49%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Source:* Zerelli and Cook (2010), page 30, based on trucker surveys, converted to percent.

Sometimes not enough trucks are available from the landlocked country to carry the quota where it is applied. In such cases the truckers’ association from the landlocked country can sell the option to carry the goods to truckers from the coastal country, leading to higher prices for transport. This is commonly the case for trucking to Niger from Cotonou.

The 1/3-2/3 rule also applies to trade between Senegal and Mali.

**Queuing Systems**

Just as the 1/3-2/3 quota system may operate in a port to allocate freight by country of truck registration, a type of queuing system may be used to allocate freight to trucks registered to each country. Transporters’ associations (not shippers’ councils) implement these queuing systems in the ports. The associations register each truck upon arrival and supervise its loading according to a first in-first out (FIFO or *tour de rôle*) rule whereby each driver registers with his transport association on arrival, joins the back of the queue, and waits his turn.

As with freight sharing rules, the queuing systems are not applied systematically to truckers in all markets and for all products. The variation in the application is presented in Table 2-7.

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Table 2-7
Application of First Come-First Served Queuing for Transit Traffic Loaded in West African Ports

<table>
<thead>
<tr>
<th>Location</th>
<th>For All Products and Seasons</th>
<th>For Some Products</th>
<th>Not at All</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidjan</td>
<td>29%</td>
<td>14%</td>
<td>67%</td>
<td>100%</td>
</tr>
<tr>
<td>Tema</td>
<td>40%</td>
<td>20%</td>
<td>40%</td>
<td>100%</td>
</tr>
<tr>
<td>Lomé</td>
<td>70%</td>
<td>15%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>Cotonou</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>36%</td>
<td>11%</td>
<td>53%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Source: Zerelli and Cook (2010), page 34, based on trucker surveys converted to percent. Updated for Cotonou from 2011 survey.*

According to Terevaninthorn and Raballand (2008), the combination of freight sharing and queuing practices leads to poor service and low productivity with no incentive to improve road transport efficiency. These results were summarized by Zerelli and Cook for different combinations of ports and landlocked countries as shown in Table 2-8.

Table 2-8

<table>
<thead>
<tr>
<th>Port</th>
<th>Destination</th>
<th>1/3-2/3 Quotas</th>
<th>First Come-First Served Queuing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidjan</td>
<td>Mali</td>
<td>No</td>
<td>Partially</td>
</tr>
<tr>
<td>Abidjan</td>
<td>Burkina Faso</td>
<td>No</td>
<td>Partially</td>
</tr>
<tr>
<td>Tema</td>
<td>Mali</td>
<td>No</td>
<td>Partially</td>
</tr>
<tr>
<td>Tema</td>
<td>Burkina Faso</td>
<td>No</td>
<td>Rarely</td>
</tr>
<tr>
<td>Tema</td>
<td>Niger</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Lomé</td>
<td>Mali</td>
<td>No</td>
<td>Partially</td>
</tr>
<tr>
<td>Lomé</td>
<td>Burkina Faso</td>
<td>No, except for shipments of rice and containerized goods</td>
<td>Partially for most goods, Yes for shipments of rice and containerized goods</td>
</tr>
<tr>
<td>Lomé</td>
<td>Niger</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cotonou</td>
<td>Mali</td>
<td>Most of the time(^a)</td>
<td>No</td>
</tr>
<tr>
<td>Cotonou</td>
<td>Burkina Faso</td>
<td>Most of the time(^a)</td>
<td>No</td>
</tr>
<tr>
<td>Cotonou</td>
<td>Niger</td>
<td>Most of the time(^a)</td>
<td>No</td>
</tr>
<tr>
<td>Dakar</td>
<td>Mali</td>
<td>Yes</td>
<td>unknown</td>
</tr>
</tbody>
</table>

\(^a\) Due to a shortage of trucks from the landlocked country, this is not always applied.


Freight allocation schemes, when they are applied, are the most costly of regulatory policies. They favor fleets of older trucks in poor condition and foster bribery of freight bureau agents charged with allocation. They also have a strong influence on the infrequent use of contracting for freight services in West Africa, which limits incentives to improve logistics (Terevaninthorn and
Raballand 2008, 5-6). Where freight allocation schemes are not applied, the more organized truckers can arrange for contracts or make arrangements through freight brokers (for a fee) to arrange their shipments. Also, in these cases, freight forwarders can select the truckers that they prefer, and make contracts with them.

**Third Country and Cabotage Regulations**

To protect the domestic trucking industry some regulations limit which truckers shippers can use. Third-country transport is when a trucker from a third country transports freight between two other countries. Cabotage is when a trucker from another country picks up and transports freight to domestic destinations. Although these regulations could be changed in the context of bilateral or multilateral treaties, the norm in West Africa is for third country trucking and cabotage to be banned (e.g., zero quota).

These regulations often force shippers to take poorer service options when choosing a truck. The chances of a breakdown, a crash, or a slow journey increase if the landlocked country fleet is less robust. Thus this protectionist allocation of freight lowers the average efficiency of north-south road haulage along that corridor. It also dissuades truckers from carrying loads to landlocked countries because they cannot get a backhaul load and compromises the creation of a flexible region-wide market for trucking. For example, Ivorian truckers have little incentive to take freight from Abidjan to destinations in Mali because they know that, if they can organize a backhaul load, the authorities will not allow them to carry it. This gives them little incentive to compete for Sahel-bound freight in Abidjan, thus reducing the competition in that market.

**Axle Load Regulations and Enforcement**

To limit road damage, UEMOA issued an axle-load control directive that sets a limit of 11.5 tons/axle. Ghana began implementing partial controls in 2005 and by early 2010 it, along with Niger, had introduced more complete controls. Benin, Burkina Faso, Côte d’Ivoire, Senegal, and Togo have yet to introduce such controls. Senegal and Mali did not meet the 2010 deadline but are expected to achieve full implementation by mid-2012. Mali installed five weighbridges at its main border crossings (which handle more than 90 percent of traffic) in 2010 and Senegal is procuring equipment and a contractor for three in Senegal, one of which is at the Port of Dakar.

In the Tema-Ouagadougou corridor integrated measures are being put in place to consistently enforce axle load limits. Axle weights are checked when trucks leave the port at Tema. Ghana has six weighbridges along its part of the corridor and Burkina Faso is installing two weighbridges to operate on the border with Ghana, at the entrance of Ouagadougou and on the border with Mali. The two one-stop border posts will include weighbridges.

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19 These are allowed in Southern Africa. (See discussion on Southern Africa at the end of this chapter).

20 See Zerelli and Cook (2010), page 46. Civil unrest in Côte d’Ivoire also diverted traffic to other corridors.


22 Ghana is not a member state of UEMOA but, surrounded by UEMOA countries, and accepts the rationale for using the same standards.
Given the preference for overloading trucks to reduce costs in most West African corridors, enforcing this regulation will be an uphill battle. In addition, if the Improved Road Transport Governance (IRTG) reports\(^2\) are to be used as a guideline, it is likely that integrity will be an issue, with both truck operators and weighbridge operators susceptible to corruption. These effects may be counteracted by the increase of indicative prices per ton (see discussion below).

**Transit Agreements**

To facilitate transit the UEMOA TRIE agreement allows goods to be transported by road with all customs-enforced duties, taxes, and restrictions suspended under cover of a single document—the State Road Transit Declaration, or Le Carnet TRIE—without requiring unloading (see Appendix B). By the end of 2010 the agreement had been partially implemented and with only limited success, in part because there is no regional guarantee system. About 70 percent of transit procedures are still rooted in bilateral accords and national regulations and practices.\(^4\)

Some states (such as Senegal and Mali) have signed bilateral agreements on the transit of goods by road, based on TRIE principles, but these are not yet functioning efficiently. Under these agreements the TRIE principles are frequently not fully implemented, and industry faces a fragmented process, having to pay the guarantee twice.

Ghana, Burkina Faso, Senegal, and Mali are working on electronic versions of the transit declaration\(^5\) and GPS-based cargo tracking, but these are only two requirements for the TRIE agreement to fully function. In most cases the truck fleet must be modernized to enable the attachment of customs seals and the approval of vehicles according to TRIE criteria, and countries must work out an arrangement for the collection and distribution of the TRIE guarantee funds. This is no small challenge in reducing the cost of transport along the Dakar-Bamako corridor. Lacking a functioning TRIE agreement, customs agencies in Senegal and Mali secure goods in transit by means of physical escorts, which cost a very steep US$358 per shipment. The pilot project of Senegal Customs to install GPS devices on transit shipments may alleviate the problem, but the devices are meant solely for tracking and cannot ensure that shipments are not tampered with. Senegal’s challenge will be to ensure that these reforms are properly implemented and coordinated without undue financial burden on the private sector.\(^6\)

**Border Crossings**

Duplication of procedures and paperwork at border crossings, and their different operating hours, contribute to transit delays. Terevaninthorn and Raballand estimate that delays at border crossings plus delays at checkpoints reduce the mileage of trucks in transit freight service by 20,000-30,000 km per year. To improve border crossing efficiency, and building on the recommendations of

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\(^2\) The Improved Road Transport Governance (IRTG) program was set up by UEMOA and the USAID West African Trade Hub, monitors international corridors in West Africa for roadblocks and checkpoints. This program conducts surveys every quarter which record the number of roadblocks, the time lost and the bribes paid by truckers. See Section 1.4.7 and Appendix C for more details.


\(^5\) A single e-TRIE carnet, or State Road Transit Declaration

\(^6\) See Booz Allen Hamilton (2010), Appendix B.
WCO SAFE Framework, ECOWAS and UEMOA are establishing joint border posts. Funding was to be provided for the construction of 11 such posts, but only three were settled on by July 2011. Implementation has been slow and at the end of 2011 these remain in the early planning stages.  

**Roadblocks and Checkpoints**

All major international corridors in West Africa have roadblocks where formal and informal payments are collected, causing delays and raising transit costs. While a relatively small percentage (5 percent on average) of total transport costs and times, they add up and reduce the competitiveness of West African businesses.

According to the 2011 IRTG survey, there was, on average, one roadblock every 50 km on international corridors for most West African countries in early 2011. In the corridor between Abidjan and the border between Côte d’Ivoire and Burkina Faso, there was a roadblock every 26 km due to the effects of the recent civil war (Figure 2-2). The situation in Côte d’Ivoire is expected to improve as the new government eliminates unofficial roadblocks.

The survey estimated that illegal payments collected at the roadblocks ranged from US$21 to US$214 per 1000 km, depending on the country. The highest were in Côte d’Ivoire (twice as high as the second highest—Mali) and the lowest were in Ghana. According to the survey, the loss of time is also significant: 2.5 to 5.5 hours per 1,000 km.

In keeping with UEMOA policy, several states are trying to reduce the number checkpoints. For example, the Government of Senegal issued a decree in 2009 limiting the number of checkpoints along its transport corridors to three, and calling for the co-location of the six authorities at checkpoints (i.e., Police, Customs, Gendarmerie, Water and Forests, and sanitary, phytosanitary and zoosanitary authorities). It is expected that the checkpoints will house the weigh stations that Senegal has agreed to put in place to meet enforcement obligations for axle loads. However, the decree is not yet in force, and the implementation timeline is unclear. Côte d’Ivoire recently announced that it will reduce checkpoints on its international corridors to eight. In Mali, “independent” national observatory agents at checkpoints have been accused of making the situation worse by accepting bribes, leading to a government reaction to reduce the numbers of observers at checkpoints. However, its indicators have remained stable at a level substantially lower than in early 2009, when the program started.

**ROAD TRANSPORT PRICING**

According to Zerelli and Cook (2010), transport prices are determined in a variety of ways in West Africa. These can be described as follows:  

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27 Monitoring of the Regional Indicative Programme, see http://www.pir-rip.ecowas.int/non-class%C3%A9-en/7th-meeting-of-uemoaecowas-joint-technical-secretariat-2/?lang=en.

28 According to Zerelli and Cook, indicative prices are higher when overloading is restricted, as in Ghana. They also collected some data that indicate haggling produced a range of +10%-15% around these prices (pages 37-38).
Where there is no allocation of freight, the free market can determine a price, usually with respect to an indicative price used by trucking associations.

Shippers in niche markets and freight forwarders for imports with direct bills of lading can arrange contracts with truckers, usually through a bidding process to determine the lowest price. This applies primarily to larger truckers in the formal sector and to markets where there is more competition among trucking companies.

For imports without a direct bill of lading, indicative prices are fixed by collective bargaining between importers and transporters represented by their respective associations.

Where control of freight allocation is strict, such as in corridors serving Niger, pressure from a coalition of transporters and shippers drives up prices.

Cartel actions by landlocked country’s truckers and trucking associations make prices for shipping strategic goods higher.

Reference prices for Lome and Tema to Bamako are somewhat higher than prices from other West African ports serving Bamako (Table 2-9). However, the prices per ton-km are within 10 percent of each other except for the port of Conakry, which is closer to Bamako but with a less efficient corridor than the others, and at much lower volumes.

Table 2-9
Reference Prices for a 40’ Container from Port to Bamako

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance (km)</th>
<th>Shipping Price</th>
<th>Price Per Ton</th>
<th>Price Per Ton-km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FCFA</td>
<td>US$</td>
<td>FCFA</td>
</tr>
<tr>
<td>Abidjan</td>
<td>1,225</td>
<td>1,600,000</td>
<td>3,181</td>
<td>53,333</td>
</tr>
<tr>
<td>Conakry</td>
<td>980</td>
<td>1,508,800</td>
<td>3,000</td>
<td>50,293</td>
</tr>
<tr>
<td>Dakar</td>
<td>1,365</td>
<td>1,502,240</td>
<td>2,987</td>
<td>50,075</td>
</tr>
<tr>
<td>Lomé</td>
<td>1,967</td>
<td>1,930,608</td>
<td>3,838</td>
<td>64,354</td>
</tr>
<tr>
<td>Tema</td>
<td>1,973</td>
<td>1,899,776</td>
<td>3,777</td>
<td>63,326</td>
</tr>
</tbody>
</table>

NOTE: Containers are generally not used for freight transport on corridors, but are used for maritime transport and stuffed and unstuffed in ports


Prices paid to transporters per ton-km are frequently less than the reference price (except in the peak seasons for agricultural goods, when they can exceed the reference price). According to Ballereau and Douabi (2010, 15), the price per ton-km between Abidjan and Bamako often falls to 33 FCFA (6.6 US cents), which is barely enough to cover costs. For backhaul freight, transporters take a further discount to 30 FCFA (6.0 US cents) to avoid an empty backhaul. Because of imbalanced demand only 20 percent of trucks in this corridor can find backhaul freight.29

29 Their analysis is supported by Zerelli and Cook (2010) in other corridors as well.
Zerelli and Cook (2010) report reference prices between Abidjan and Bamako to be 31-34 FCFA/ton-km (6.2-6.8 US cents) and for Abidjan to Ouagadougou to be 25-28 FCFA/ton-km (5.0-5.6 US cents). These prices, of course, discourage the transport of containers on inland routes since they constrain the overloading of vehicles. Containerized goods constitute about 14 percent of imports and 30 percent of exports in transit traffic.\(^3\)

Prices obtained for the Cotonou-Niamey corridor in December 2011 indicate a range of 47-53 FCFA/ton-km (US$ 0.09-0.11). This is higher than those reported for other corridors in the past. However, it reflects a 20 percent increase due to the enforcement of UEMOA axle load regulations and higher fuel prices. Prices in other corridors are also increasing due to both higher fuel prices\(^3\) and the partial implementation of axle load controls and they could also be in the US$0.085-0.095 range at this time.

**Impact of Policies and Enforcement on Prices**

Regulatory policies are key in keeping transport prices high in West Africa and, in combination with the “coalition of interest groups against change” in this region cited by Terevaninthorn and Raballand (2008), greatly reduce the potential effectiveness of other measures that would reduce vehicle operating costs but not transport prices. Therefore, changes in policies and enforcement are the critical factors in reducing prices.

**Impact of Axle Load Policy on Prices**

Promoters of the axle load limitation policy expected that it would not only reduce road-maintenance costs and accidents but also oblige informal truckers (who depend on overloading to make a profit) to withdraw from the market. The resulting regional fleet would be more modern in its capital and management and thus more efficient. But they reckoned this without the solution that truckers’ associations and shippers’ councils then negotiated: they agreed to raise transport prices by more than 20 percent to restore approximately the pre-existing level of profitability for most informal interstate truckers.\(^3\) They also reported that the reference price for Lome-Niamey rose about 25 percent to 44 FCFA/ton-km after the imposition of axle load restrictions. Transport prices for certain commodities selected for early enforcement (e.g., cement) in the Tema-Ouagadougou corridor initially rose 50 percent then settled to a 30 percent increase with axle load enforcement container transport rates varying in a similar fashion.\(^3\)

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\(^3\) Based on data from Nathan Associates Inc., (2010) for Burkina Faso traffic.
\(^3\) A comparison of 2010 and 2006 fuel prices shows an average 27 percent increase for the eight countries, but Niger and Ghana decreased slightly while others (Mali, Burkina Faso, Cote d’Ivoire, and Senegal) rose 30-60 percent.
\(^3\) For example, Niger’s transporters’ association requested an increase from 38,000 to 71,000 CFA francs per ton for the trip from Tema to Niamey. The importers accepted 67,000 CFA francs according to Zerelli and Cook (2010).
\(^3\) See detailed discussion on pricing in Vision Consult Limited (2011).
Figure 2-2
Road Checkpoints in West Africa

SOURCE: IRTG (2011), January 1- March 31, 2011. Note figures are per 100 km.
According to Zerelli and Cook this “arguably perverse” solution means that end users (not inefficient transporters) are expected to pay the cost of the axle-load control policy with the same inefficient transport. Unprofitable transporters using old vehicles remain in business while formal truckers presumably make higher profits than they did before. In addition, any trucker hauling containers must now surely generate very high profits because containers, which were rarely heavy enough to generate axle-weights that exceeded the new limits, also benefit from extra profit due to the higher trucking prices.

**Informal Payments and Incentives**
The inefficient trucking system in West Africa is self-perpetuating through a set of informal-sector incentives. Drivers pay bribes to agents of the organizations overseeing the monopoly to allow their trucks to jump the queue. The shipper benefits from the extra tons of freight loaded beyond legal limits but not declared to customs at the border between the coastal and landlocked country. The shipper rewards the shipping agent accordingly. The shipping agent gives additional cash incentives to the driver who, in turn, pays bribes to police and customs officers to ensure that the overloaded truck and the under-declared cargo reach their destination without detention or official fines. Trucking company staff ignore overloading if it does not significantly damage the truck (Zerelli and Cook 2010, 12).

**Pricing and Profitability**
According to Terevaninthorn and Raballand, trucking is profitable for most companies in Africa, especially in the main corridors. They cite findings that indicate a profit margin of 80 percent in two West African corridors with prices of US$3.5-US$4/truck-km in West Africa (much higher than for Southern African corridors).

Zerelli and Cook (2010, 21 and 22) report that formal and informal truckers have approximately the same profitability per trip despite their different cost structures, and that the percentage is much lower on average than that reported by Terevaninthorn and Raballand. However, the annual profit for formal truckers is twice as high as for informal truckers due their greater number of round trips per year per vehicle.

Data on trucker profitability in Niger and Benin collected for this study show that profitability is tied to high down times for truckers and low percent backhauls, characteristics perpetuated by the current system.

**Impact of Turn-around Time and Delays on Profitability**
Profitability is closely related to turnaround time or number of trips per month that a trucker can make. One Malian trucker interviewed by Zerelli and Cook noted that the profit margin on current pricing was reasonable for a minimum of 1.5 round trips per month, which the productive fleets of the formal sector can attain. In contrast, most transporters in the informal sector make only one roundtrip per month with poorly performing rigs and merely stay in business. Several operators in the interviews highlighted the fact that, given the high risks associated with regional

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34 This difference is related to different data collection and analysis techniques.
transport, a flat tire or mechanical breakdown can transform this low profit margin into a deficit which, they claimed, informal truckers experience often. On a yearly basis Zerelli and Cook estimate that formal sector operators average 17 round trips per year in the Cotonou-Niamey corridor while informal sector truckers average 10.

Turnaround time (and profitability) is increased when delays en-route are reduced and/or a trucker can arrange backhauls quickly. Typical delays for West African corridors are shown in Table 2-10. The non-driving time delays represent 80-85 percent of total truck operator times.35

Table 2-10
Average Trucker Times for a Round Trip on Corridors serving Bamako in 2009 (days)

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Port Delays</th>
<th>Driving Time</th>
<th>Border Crossings &amp; Roadblocks</th>
<th>Terminal Delays</th>
<th>Other Delays (e.g., Repairs)</th>
<th>Total Round Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidjan</td>
<td>1,225</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Conakry</td>
<td>980</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Dakar</td>
<td>1,365</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Lomé</td>
<td>1,967</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Tema</td>
<td>1,973</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>13</td>
</tr>
</tbody>
</table>

Source: Ballereau and Douabi (2010).

Other Influences on Profitability

In addition to being influenced by government policies and regulation and trucking business practices, road transport profitability is influenced by two factors beyond the control of transporters or governments: trade seasonality and trade imbalance.

Trade Seasonality. Trucking profitability in West Africa is often dictated by agricultural calendars. Postharvest demand for trucking of cotton, cocoa and coffee means more demand for southbound trucking in coastal countries, resulting in faster round trips and higher profits. This demand also means fewer trucks for trade between ports and Sahelian countries at this time. Conversely, there is often an oversupply of trucks at other times: a representative of a Togolese truckers’ association noted the tendency for an oversupply of trucks in Lomé from December to May. Seasonality also occurs for other reasons: a Malian interviewed in Tema noted an undersupply of trucks during the run-up to the Muslim fasting month of Ramadan, to the start of the school year and to end-of-year holidays, with a consequent seasonality in trucking profitability (Zerelli and Cook 2010, 26).

Trade Imbalance. The volume of imports to landlocked countries compared to exports creates a scarcity of backhaul loads that affects transport profitability, especially for truckers from coastal countries who may be prohibited from carrying return loads. Average round-trip load factors vary between 0.75 for truckers who have access to return freight and 0.5 for those who do not. Some

35 Average transit times for shipments in these corridors are significantly less than total trucker times, since the shipments do not experience the truck waiting times or the majority of the repair times when out of service. Total downtime for trucks in “other delays” also increases with truck age.
formal sector trucking companies in niche markets with contracts for return freight can achieve a factor close to 0.9, but they are a minority. Less than 21 percent of truckers could find a backhaul if it were limited to full truck loads in the present market for West African landlocked countries where the proportion of export tonnage to import tonnage varies from 14 percent to 30 percent and rail shares in one of the two multimodal corridors (Dakar-Bamako) are higher for exports (Table 2-11). Since some truckers carry partial backhaul loads, the percentage of trucks with at least some backhaul freight is slightly higher.

### Table 2-11

<table>
<thead>
<tr>
<th></th>
<th>Burkina Faso</th>
<th>Mali</th>
<th>Niger</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total imports</td>
<td>2,981</td>
<td>2,434</td>
<td>2,348</td>
<td>7,763</td>
</tr>
<tr>
<td>Total exports</td>
<td>417</td>
<td>487</td>
<td>696</td>
<td>1,600</td>
</tr>
<tr>
<td>Percent exports/imports</td>
<td>14</td>
<td>20</td>
<td>30</td>
<td>21</td>
</tr>
</tbody>
</table>


### SOUTHERN AFRICA ROAD TRANSPORT AS A BENCHMARK

Terevaninthorn and Raballand cite Southern Africa, particularly the North-South corridor (connecting the port of Durban to Zambia and other landlocked countries), as having Africa’s most advanced road transport system, including regulatory regimes and logistics efficiency. They state that the transport market and operations in Southern Africa are of great interest for other countries in Africa because they combine liberalization with enforcement of quality and load control rules applicable to all trucking operators. We therefore use road transport operations in this region as a benchmark for potential improvements in West Africa.

### Transport Corridors in Southern Africa

There are six transport corridors serving Zambia. The largest traffic flows, shown by line width in Figure 2-3, are on the North-South Corridor connecting Lubumbashi (DR Congo) and Lusaka (Zambia) with Pretoria and the port of Durban in South Africa. The corridors to the ports of Dar-es-Salam, Beira, and Walvis Bay (not shown in Figure 2-3) carry smaller but still significant volumes.

### Freight Volumes

For the purpose of this report we focus on Zambian trade. Zambia’s total trade volume in 2009 is estimated at 5.8 million tons, of which 2.5 million were exports and 3.3 million imports. The main products transported by road to and from Zambia are

- Mining inputs and outputs (ores, concentrates, metals, sulfur, sulfuric acid, coal),
- Agricultural (sugar, tobacco, cotton),
- Fuels (diesel and petrol),
- Food (bulk grain).
Its main trading partner is South Africa, accounting for 2.5 million tons per year (44 percent of the estimated total freight traffic in 2009, including 60 percent of exports and 30 percent of imports). Overseas trade accounted for 29 percent of exports and 56 percent of imports or about

**Figure 2-3**

*Main Transport Corridors Serving Zambia*

*Source: SOFRECO and NATHAN ASSOCIATES (2011).*

*Note: The width of the lines indicates traffic levels and the colors indicate priorities for improvements.*
36 percent of total trade.\textsuperscript{36} About 70 percent of both imports and exports are hauled by road and 30 percent by rail.

As in West Africa, only a small percentage (10 percent) of the general cargo trade on Zambia’s routes from South Africa is containerized for costs savings reasons. Trucks have increased payloads and volumetric capacity when not containerized.\textsuperscript{37}

**Trucking Environment in Southern Africa**

Bilateral agreements govern transport to and from Southern African countries. Unlike in West Africa, these agreements do not establish quotas and do not support a first come-first served rule for truckers picking up loads. This enables direct contracting between shippers and transporters and creates incentives for transporters to be more efficient. However, these agreements do have some restrictions and some provisions to facilitate transport. Namely they\textsuperscript{38}

- Restrict the carriage of bilateral trade to carriers from the two countries
- Prohibit cabotage
- Provide that the regulatory authorities of the two parties shall share information concerning traffic development
- Define the types of permits that may be issued, namely 14 days, short term (3 months), and long term (12 months)\textsuperscript{39}
- State that cargo rates and charges shall be determined by the market
- Provide for the establishment of a joint route management group to determine transport needs on a route, among other things.

Road transport restrictions in Southern Africa are compared with West Africa in Table 2-12.

<table>
<thead>
<tr>
<th>Restriction</th>
<th>West Africa</th>
<th>Southern Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral agreements</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Quotas/freight allocation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Queuing systems</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cabotage</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Third country rule</td>
<td>Prohibited</td>
<td>Allowed in some cases (for Zimbabwe)</td>
</tr>
<tr>
<td>Technical regulations</td>
<td>Problem of harmonization and enforcement of axle load regulations, cumbersome transit procedures inducing border crossing delays</td>
<td>Cumbersome transit procedures inducing border crossing delays. Axle load limitations mostly respected. Corridor management and data sharing supported.</td>
</tr>
</tbody>
</table>

*Source: Based on Terevaninthorn and Raballand (2008).*

\textsuperscript{36} Figures from SOFRECO (2011).
\textsuperscript{37} See Raballand et al. (2008).
\textsuperscript{38} Terevaninthorn and Raballand (2008), page 35.
\textsuperscript{39} Short term permits are less expensive than long term permits.
Comparison of Monthly Mileage in Southern and Western Africa

Several studies have compared monthly (and annual) mileage between different regions in Africa. These are summarized by ECOWAS (2007) in terms of the average monthly distance traveled by trucks in Southern and Western Africa (Table 2-13). There is a much greater range for West African countries due to the wide range of policy environments as discussed above.

<table>
<thead>
<tr>
<th>Location</th>
<th>Monthly Mileage</th>
<th>Annual Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa Domestic Transport</td>
<td>11,000-12,000 km</td>
<td>132,000-144,000 km</td>
</tr>
<tr>
<td>Southern Africa Regional Transport</td>
<td>8,000-9,000 km</td>
<td>96,000-108,000 km</td>
</tr>
<tr>
<td>West Africa Regional Transport</td>
<td>2,500-7,500</td>
<td>30,000-90,000</td>
</tr>
</tbody>
</table>

*Source: ECOWAS (2010), Table 3 and consultant calculations.*

Data on age and annual mileage also suggest the potential impact of moving to Southern African conditions (Table 2-14). Since most trucks in Southern African transit operations are used to a 12-year life, the mileage falls off rapidly after that age.

<table>
<thead>
<tr>
<th>Age</th>
<th>West Africa</th>
<th>Southern Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-15 years</td>
<td>20,000—55,000</td>
<td>55,000—65,000</td>
</tr>
<tr>
<td>5-10 years</td>
<td>40,000—65,000</td>
<td>110,000—165,000</td>
</tr>
</tbody>
</table>

*Source: Terevaninthorn and Raballand (2008), graph interpreted by consultant.*

Road Transport Prices in Southern Africa

Road transport tariffs in Zambia are low, especially for a landlocked country. In June 2006, those tariffs averaged between 3.7 US cents and 5.6 US cents per ton-km. With increases in oil prices these transport prices will have risen by 10-15 percent since 2006 and should be in the range of 4-6.2 US cents per ton-km now.

Road transport prices in Southern Africa vary by transport corridor because of trade imbalances. With an overall backhaul percentage of 75 percent, Zambia’s trade is not as unbalanced as West Africa’s but this is distributed unevenly, with the North-South corridor attracting the majority of the backhaul traffic (Table 2-15). Thus, other corridors have an imbalance similar to West Africa’s, though only the Dar-es-Salam corridor shows a substantial discount for backhaul traffic.

The balanced trade in the North-South corridor makes for a more profitable trucking sector and is another factor, in addition to liberalized policies that reduce costs and prices per ton-km in the

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40 They also show East Africa for comparison as 5,000-6,000 km per month.
Dar corridor. The Dar corridor competes successfully with the North-South corridor for Zambian exports with overseas destinations. However, the trucking industry is less profitable in that corridor.

### Table 2-15
*Road Transport Pricing in Southern African Corridors*

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Distance from Ndola, Zambia</th>
<th>Imports/Exports (%)</th>
<th>Transport Price (US$) Per ton</th>
<th>Imports</th>
<th>Exports</th>
<th>Per ton-km</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dar-es-Salam</td>
<td>1,970 km</td>
<td>65/35</td>
<td>80</td>
<td>0.040</td>
<td>0.025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North-South</td>
<td>3,000 km</td>
<td>50/50</td>
<td>120</td>
<td>0.040</td>
<td>0.040</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Durban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beira</td>
<td>1,400 km</td>
<td>80/20</td>
<td>100</td>
<td>0.071</td>
<td>0.071</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walvis Bay</td>
<td>2,300 km</td>
<td>80/20</td>
<td>160</td>
<td>0.070</td>
<td>0.070</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Raballand et al. (2008), page 8.*

### Trucking Industry Practices and Input Costs

Larger formal road transport operators (with 50 or more trucks) in Zambia and South Africa have a clear advantage over smaller operators because they have a broader customer profile and more flexible operating conditions. Hence, they are better able to secure backhauls. Due to the current high demand for transport services in Zambia, large operators have nearly 100 percent backhauls, which greatly enhances the trucking sector’s profitability and competitiveness. (Appendix C provides a typology of Zambian trucks.)

Two important inputs in setting tariffs are transport costs and average loads. The South Africa Road Freight Association reports total operating costs for a seven axle interlink, typically used on the Zambia–South Africa route, to be US$0.93 per km for a truck with an average payload of 33.9 tons. The average load for these vehicles is 35 tons, including some overloading, but not as much as in West Africa. Overloading has been decreasing in Southern Africa as axle load limits are enforced.

For cross-border transportation, Zambian large companies and South African transport companies face similar transport costs, which make Zambian companies competitive. However, for domestic traffic, small Zambian companies are less competitive than South African ones (mainly due to higher fuel costs).

Two inputs affect the competitiveness of Zambian and South African truckers: fuel prices and truck import rules.

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41 This section is largely taken from Raballand et al. (2008).
**Fuel Prices and Costs**

Fuel prices in Zambia are higher than in other countries in Southern Africa. In June 2006, the price for diesel fuel in Zambia reached the equivalent of US$1.50 per liter. In South Africa, Botswana and Zimbabwe, the equivalent price was about US$1 per liter (depending on exchange rates).

These fuel price differences affect the structure of operator costs. The South African Road Freight Association (RFA) Vehicle Cost Schedule records the fuel and lubricants costs for a seven-axle interlink to be 32.6 percent of total operating costs. In Zambia, the fuel cost component reaches 45 percent of total operating costs, making diesel fuel the largest cost element in Zambian operators’ transport costs. Otherwise, if fuel costs were similar to neighboring countries, domestic transport costs would be lower than South African operators transport costs. International truckers from Zambia fill their tanks outside the country, when possible.

**Truck Import Rules**

In South Africa the importation of used and depreciated vehicles is prohibited. Such imports require an import permit, which is very rarely granted except in special circumstances (returning residents, immigrants and special motivated circumstances). Elsewhere in the other SADC countries, Zambia included, import permits are issued freely, as long as tariffs and duties are paid.

Imports of used trucks result in savings in the initial purchase price and the subsequent financing and depreciation costs. A Zambian operator can purchase a 3- to 4-year-old heavy truck with about 320,000–480,000 km on the odometer for about US$25,000 to US$40,000, whereas a South African operator will have to pay between US$100,000 and US$150,000 for a new unit.

Maintenance costs for the Zambian operators will be higher, but this additional cost is more than offset by savings in depreciation costs and this gives them an advantage in their competition with the larger South African companies. Almost all trucks registered in Zambia are purchased used, mostly from the UK, or from the United States s left hand drive units. Left hand drive vehicles cannot be registered in South Africa, and they are not allowed under the SADC Protocol on Transport, Communications and Meteorology.

**Trucking Fleet Ownership in Zambia**

The size of the Zambian heavy goods vehicle fleet is estimated at 1,500-1,700 trucks (2011).\(^42\) An estimated 70 percent of this fleet is owned by formal sector operators and 30 percent by informal operators without modern management procedures. The average age of this fleet is estimated at 8 years.

Trucking along the main corridors serving Zambia is carried out by a combination of Zambian trucks, South African trucks, and trucks from other countries (e.g., Zimbabwe). The market is highly competitive, with Zambian trucking companies’ market share at 30 percent to 40 percent. In some corridors, such as the North-South corridor, foreign trucks account for as much as 70

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\(^42\) Based on an increase of 20 percent over the fleet size in 2006 of 1,300-1,500 vehicles.
percent to 80 percent of traffic. The average age of the trucks in this international traffic (5-6 years) is lower than for Zambian domestic fleets.

The number of foreign trucks in Zambia is high because Zambia is a major exporter in terms of freight volume, which makes it economically viable for South African companies to make roundtrips. The South African fleet is the largest in the sub-region benefiting from economies of scale. The Gauteng (South Africa) truck fleet of heavy trucks is about eight times larger than the Zambian fleet. (See Appendix C for details.)

Large South African trucking companies have taken over several large Zambian companies, which has made Zambia’s trucking industry more competitive. Investing in the industry is mainly how South African companies bypass market entry barriers in Zambia. Although these large companies benefit from South African capital, they are managed mostly by Zambians (Raballand et al. 2008, 14 and 15).

**Conclusions on Southern African vs. West African Trucking**

The transport prices practiced in Southern Africa for the main corridors (Dar-es-Salam and North-South) are substantially lower than in West Africa (US cents 2.5-4/ton-km compared with US cents 6.4-7.3/ton-km) and they show a competitive market operating more efficiently. There are suggestions that they could be even lower with relaxation of the cabotage regulations. Even after adjusting for trade imbalance, there appears to be a major potential for improvement in West African prices if the road industry environment is changed to be similar to that in Southern Africa.
3. Conceptual Framework for an Impact Assessment Model

This chapter elaborates the conceptual framework that was sketched out in the Concept Note and the Workshop Summary Report for this project. It is based on the literature identified and an analysis of data collected under this study and previous studies in West Africa, Southern Africa, and other regions of the world.

OVERVIEW
The conceptual framework for the impact assessment model is composed of ten modules as shown in Figure 3-1 and listed here:

1. Reform Identification
2. Effect on Trucking Industry Structure
3. Calculation of Impacts on Trucking Operations and Truck Fleets
4. Calculation of Impacts on Transport Costs and Prices
5. Calculation of Impacts on Trucking Industry Employment
6. Calculation of Impacts on Axle Loads and Road Maintenance and Repair Costs
7. Calculation of Impacts on Import/Export Prices and Trade
8. Calculation of Impacts on Non-Trucking Industry Employment
9. Base Data and Assumptions
10. Summary of Impacts by Group

Each of these modules is described below. 43

43 An eleventh module could be added to aggregate the effects of the other modules on GDP, but this is not attempted in this report.
Figure 3-1
Overview of Impact Assessment Modules

Reform Identification

- Effects on Trucking Industry Structure
- Calculation of Impacts on Trucking Operations and Truck Fleets
- Calculation of Impacts on Transport Costs and Prices
- Calculation of Impacts on Import/Export Goods Prices and Trade
- Calculation of Impacts on Axle Loads and Road Maintenance and Repair Costs
- Calculation of Impacts on Non-Trucking Employment

Base Data and Assumptions

Summary of Impacts by Group
REFORM IDENTIFICATION

Potential Types of Reforms and Policy Actions
When importers and exporters contract freely with trucking companies, competition determines the most beneficial arrangements for both parties in terms of price and quality of service. This competition has been shown to lower tariffs, make fleets more efficient, and move trucking operators toward more modern fleets and professional operations.\(^\text{44}\) To accomplish this in West Africa, four types of reform or policy actions are needed:

- Elimination of quotas and queuing
- Quality licensing of vehicles and drivers\(^\text{45}\)
- Tax/subsidy incentives to modernize fleets
- Minimizing of border formalities and road checkpoints.

These reforms are discussed in Arvis et al. (2010) with recommendations on possible methods of implementation, many of which could apply to West Africa. These reforms have a number of direct and indirect effects that are analyzed below as a series of modules. The refinement of this list and specification of reforms is left for further study (see Chapter 7).

These reforms must be specified by country in the model. They will also have different impacts in each country depending on existence and enforcement of quotas and other policies. We use 2015 as a reference year in calculating the impact of reforms, as they will take some time to be implemented.

Linkage of Reforms to Potential Industry Changes
Each type of reform has different linkages to changes in the trucking industry and to other impacts (see Table 3-1 and Figure 3-2). How these linkages can be modeled is further described in Chapter 4.

Table 3-1  
Linkages of Reforms to Trucking Industry Changes

<table>
<thead>
<tr>
<th>Reform</th>
<th>Linkage to Operations</th>
<th>Other Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elimination of quotas and queuing</td>
<td>• Reduction of waiting times in queues to get loads in favor of direct contracting or contracting through cargo brokers</td>
<td>• Expansion of cargo broker industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Elimination of cargo allocation units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduction of total trip times and increase in annual mileage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduction in informal payments</td>
</tr>
</tbody>
</table>

\(^{44}\) See Terevaninthorn and Raballand (2008) and Arvis et al. (2010).

\(^{45}\) See Arvis et al. (2010) pages 105-106. Quality licensing could restrict licenses for international trucking to vehicles and operators that meet minimum standards of vehicle age and condition and certification of professional standards for trucking companies, vehicles and drivers.
### Table: Reform Impacts

<table>
<thead>
<tr>
<th>Reform</th>
<th>Linkage to Operations</th>
<th>Other Impacts</th>
</tr>
</thead>
</table>
| Quality licensing of vehicles and drivers  | • Restriction of transit transport to operators and vehicles with modern, professional certification | • Modernization of fleets to meet standards with change in age distribution of fleets  
• Encouragement of formal trucking sector with modern management  
• Retraining and new procedures for government licensing units |
| Tax subsidy/incentive to modernize fleets   | • Provision of either direct subsidies or reduced import tariffs for modern truck purchases and/or subsidized loans for truck purchases | • Lower purchase costs for new trucks  
• Modernization of fleets with change in age distribution of fleets  
• Encouragement of formal trucking sector with modern management |
| Minimizing border formalities and road checkpoints | • Reduction of waiting times at borders and checkpoints  
• Reduction in transit costs | • Reduction of total trip times and increase in annual mileage  
• Reduction in informal payments |

### Figure 3-2
Reform Identification Module

- **Inputs from Base Data and Assumptions Module**
  (Base data on delays and trucking costs, benchmarks on performance and pricing in Southern Africa)

- **Output to Other Modules**

- **Reform Specification by Country**
  - Elimination of Quotas and Queuing (reducing truck and driver waiting times and increasing competition)
  - Quality Licensing of Vehicles and Fleets (increasing pressure to modernize)
  - Subsidy Incentives to Modernize Fleets
  - Reduction in border crossing and checkpoint delays and payments
EFFECT ON TRUCKING INDUSTRY STRUCTURE

The reforms and their linkage to the trucking industry will lead to change in the industry. This relatively simple module will track expected changes in

- The size distribution of trucking firms in the formal and informal sectors
- The percentage of the fleet run by formal and informal trucking firms
- The total capacity required of truck fleets to meet future demand.

These changes will be based on a comparison of base year data with data from Southern Africa. These relationships are shown in Figure 3-3. The assumptions used to create these functions are discussed in Chapter 4.

**Figure 3-3**
*Effect on Trucking Industry Module*
CALCULATION OF IMPACTS ON TRUCKING OPERATIONS AND TRUCK FLEETS

The reforms and their linkage to the trucking industry will lead to change in trucking operations and fleets. This more complex module will track expected changes in

- The productivity in annual km for different country fleets and operator types
- Total truck round trip times for different country fleets and operator types
- The size and age distribution of the truck fleets by country and operator type
- Annual truck availability of the truck fleets by country and operator type
- The change in the number of trucks for future fleets by country and operator type.

These calculations use the benchmarks for trucking in Southern Africa with adjustment for demand imbalances to fix the potential for productivity in each country’s transit fleet by type of operator (formal or informal). This takes into account the expected shift in age distribution of the fleets due to reforms. The effect on domestic fleets is calculated in a less detailed manner, taking into account the change in industry structure. The primary outputs are the size of truck fleets and their annual km by country and operator type, and their changes from base year levels.

These relationships are shown in Figure 3-4. The assumptions used to create these functions are discussed in Chapter 4.

**Figure 3-4**
*Module for Calculation of Impacts on Trucking Operations and Fleets*

- **From Trucking Industry Module**
- a. Total future ton-km for truck fleet by country and type of firm
- **Future number of available trucks by country, type of firm, size, and age of truck**
  - **Change in number of trucks by country and type of firm**
  - **Increased annual km (loaded and unloaded) by size and age of truck, country and type of firm**
- **Decreased delay and down time per round trip by size and age of truck, country and type of firm**

- **From Reform Module**
  - b. Reduction in border and checkpoint delays

- **Input from Base Data and Assumptions Module**
  - (Base fleet size and distribution, annual km, availability, future demand balance, benchmarks on trucking industry structure and performance in Southern Africa)
CALCULATION OF IMPACTS ON TRANSPORT COSTS AND PRICES

The reforms and their impacts on the trucking industry and its productivity will lead to changes in transport costs and prices. This moderately complex module will track expected changes in

- The variable and fixed costs of operations by type of truck and type of operator
- Total costs per trip by type of truck and type of operator
- Average costs per ton-km by type of truck and type of operator
- Average prices for transport by country and operator type
- Expected average profitability by country fleet and operator type.

These calculations use the benchmarks for pricing in Southern Africa relative to cost, adjusted for trade imbalance, combined with the data on the structure and productivity of the trucking industry and fleet composition from the previous module and base data on vehicle operating costs transit fleet by type of operator (formal or informal). This takes into account the expected shift in age distribution of the fleets due to the reforms. The primary outputs are the average costs and prices per ton-km and the change from base year data.

These relationships are shown in Figure 3-5. The assumptions used to create these functions are discussed in Chapter 4.

Figure 3-5
Module for Calculation of Impacts on Transport Costs and Prices
CALCULATION OF IMPACTS ON TRUCKING INDUSTRY EMPLOYMENT

The future changes in the size and structure of the trucking industry and the productivity of trucks will lead to changes in employment in the trucking industry. This relatively simple module will track expected changes in

- The employment in trucking firms in the formal and informal sectors
- The level of qualifications for drivers in the trucking industry.

These changes will be based on a comparison of base year data with data from Southern Africa. These relationships are shown in Figure 3-6. The assumptions used to create these functions are discussed in Chapter 4.

Figure 3-6
Module for Calculating the Impacts on Trucking Industry Employment
CALCULATION OF IMPACTS ON AXLE LOADS AND ROAD MAINTENANCE AND REPAIR COSTS

The reforms and their impact on the trucking industry and its productivity will lead to changes in vehicle loading. The overall rate of overloading is expected to decrease as operators, especially in the formal sector, obey the regulations. This will reduce costs for road maintenance and repairs. This moderately complex module is expected to track changes in

- Expected overloading by type of truck and type of operator
- Total costs by the government to maintain and repair roads in major corridors
- Total extra costs for vehicle operation due to road deterioration linked to overloading.

These calculations use benchmarks for overloading in Southern Africa by type of operator, and base data on costs of road maintenance and repair and the effects of overloading on road pavements. The primary outputs are: (1) the expected percentage of overloaded vehicles, (2) the total annualized amount spent on road maintenance and repair in the future reference year and (3) the total extra amount spent by road users in the reference year due to overloading. These relationships are shown in Figure 3-7. The assumptions used to create these functions are discussed in Chapter 4.

Figure 3-7
Module for Calculation of Impacts on Axle Loads, Road Maintenance and Repair Costs and Vehicle Operating Costs
CALCULATION OF IMPACTS ON IMPORT/EXPORT PRICES AND TRADE

As noted in the previous module, reforms are expected to lead to reductions in transport prices. These prices in turn are expected to lead to increased trade for landlocked countries. This relatively complex module will track expected changes in

- The prices of imports to and exports from landlocked countries by type of commodity
- The potential increase in imports or exports by type of commodity and by landlocked country

These calculations use base price and volume data for four major commodity groups (agricultural products, minerals, fuel and non-resource based goods) and a set of estimated price elasticities for these groups to determine future trade values and volumes, which are the primary outputs of this module. These relationships are shown in Figure 3-8. The assumptions used to create these functions are discussed in Chapter 4.

Figure 3-8
Module for Calculation of Import/Export Prices and Trade
CALCULATION OF IMPACTS ON NON-TRUCKING INDUSTRY EMPLOYMENT

The reforms will lead to indirect changes outside the trucking industry with implications for non-trucking employment. This module is designed to track expected changes in

- Indirect trucking-related employment
- Indirect trade-related employment.

These changes will be based on multipliers applied to data generated from the trucking employment and trade modules. These relationships are shown in Figure 3-9. The assumptions used to create these functions are discussed in Chapter 4.

**Figure 3-9**
*Module for Calculating Impacts on Non-Trucking Industry Employment*
BASE DATA AND ASSUMPTIONS
This module contains the data bases and assumptions that support calculations in the other modules. These include

- Base data on
  - Domestic and transit trucking industry structure, operations and costs in each country in West Africa and for Zambia in Southern Africa
  - Transport pricing in West Africa and Southern Africa.

- Assumptions about
  - Effects of reform on domestic and transit trucking structure, operations, and costs
  - Employment multipliers
  - The relationship of trade to transport prices
  - Future transport demand in West African countries.

This module will be linked to others for supplying data as specified in the figures in this chapter. Details on assumptions and base data are provided in Chapters 4, 5 and 6 and in Appendix D.

SUMMARY OF IMPACTS BY GROUP
This module summarizes the impacts calculated in the previous modules and presents the data in user-friendly forms for different stakeholders. Impacts tracked in this module are as follows:

- Change in fleet size by country and operator type
- Change in average annual km by country and operator type
- Change in average transport costs per ton-km by country and operator type
- Change in average transport prices to landlocked countries
- Change in total transport price paid by shippers by landlocked country
- Change in total value and volume of trade by landlocked country
- Change in total cost of road maintenance and repair by country
- Change in total trucking and non-trucking industry employment by country

The following stakeholders are identified along with selected impacts:

- Trucking firms (by type of operation and country)
- Shippers (importers and exporters) in landlocked countries
- Consumers and purchasers of intermediate goods in landlocked countries
- Exporters from landlocked countries
- Government by country.

This is illustrated in Figure 3-10. Some other impacts can also be identified, but not quantified at this time. These are as follows:

- Value of time and reliability gains related to improved logistics for shippers
- Increased business for cargo brokers in both coastal and landlocked countries
- Elimination of freight allocation agency employees
- Change in employment covered by social security programs
- Reduced road accident rates due to modernized truck fleets
- Increase in GDP associated with reduced transport costs and trade increases
- Decrease in the costs of pollution and use of carbon fuels.
There may be other significant impacts that should also be examined in later studies.

**Figure 3-10**  
*Summary of Impacts Module*

- **From Trucking Operations Module**
  - a. Fleet size and annual km by country and operator type
  - Change in fleet size by country and operator type
  - Average change in annual km by country and operator type

- **From Trucking Cost and Price Module**
  - b. Average transport cost and price per ton-km
  - Average change in transport cost and price by country and operator type
  - Total change in transport price paid by shippers by country

- **From Trade Module**
  - c. Total trade by country
  - Total change in value and volume of trade by country
  - Total change in producer and consumer surplus by country

- **From Overloading Module**
  - d. Total cost of road maintenance and repair
  - Total change in cost of road maintenance and repair by country

- **From Employment Modules**
  - e. Total direct and indirect employment by country
  - Total change in trucking and non-trucking employment by country

**Inputs from Base Data and Assumptions Module**
4. Options for Modeling Reform Impact

This chapter describes options for modeling in each general component of the conceptual framework. The best potential modeling is identified for each, along with a level of simplified modeling that can be done as part of the current preliminary modeling exercise. The chapter is divided into discussions of direct and indirect impacts on the trucking industry and indirect impacts outside the industry.

IMPACTS ON THE TRUCKING INDUSTRY
The modeling of impacts on the trucking industry can be divided into three components:

- Modeling industry structure
- Modeling industry operations and employment
- Modeling industry costs.

This modeling can be done using a combination of macro and microeconomic analysis summarized at the country and stakeholder levels as explained below.

Industry Structure
We define the structure of the trucking industry in this report by firm type (formal and informal)46 and by firm size (small, medium, large). Modeling of industry structure must be done on a macro or country level. This can best be carried out using a model based on econometric methods; however, this type of model does not yet exist.

For the purpose of a preliminary model that can estimate the impact of reform on industry structure, one can establish a benchmark industry structure with a complete package of reforms based on benchmark data from Southern Africa. Then the model can assume that this structure will be reached wholly or partly in a given country by means of reforms in that country. The more complete the reform package, the closer the industry would get to the benchmark structure. This is the model used in this report with benchmark data from Southern Africa.

46 Own-account operators should also be examined, but then separated into formal and informal operations to simplify the modeling.
Trucking Industry Operations, Employment, and Costs

Modeling of trucking industry operations can best be done by starting on the micro level. This approach first identifies typical operator types (formal and informal) and typical truck types in each truck category (medium, large, very large). Average statistics for these typical types can then be gathered by survey methods for specific transport corridors and related to the results of previous surveys to fill in the gaps. This approach is applicable for estimating productivity in annual km, load factors for trucks, trucking industry employment, and some components of fixed and variable operating costs. Assumptions can then be made concerning future changes in the percentage of operators and their fleets and productivities in these categories with reforms, with the cost functions for each vehicle type by operator type remaining the same (except for informal payments). (See Appendix D for assumptions in the preliminary model.)

For calculating typical truck operating costs and costs per ton-km, a combination of survey data and HDM4 VOC model results as used by Terevaninthorn and Raballand (2008) is best. These data can be used to estimate standard fixed and variable costs for the region, which is useful in eliminating the effects of minor variations of costs between countries that are not related to policies.

These data by type can then be aggregated to country level by multiplying the micro data by total demand in terms of ton-km for each operator type and truck type. This is the approach used in this report.

Transport Prices

Modeling of transport prices must be done at the macro level because a combination of factors is involved: transport costs, competition, and the influence of stakeholders in negotiations. A macroeconomic study is the best approach for this aspect of impact analysis. However, no study of this type is available for African countries, although there is some analysis of the relevant factors in Terevaninthorn and Raballand (2008).

For the purpose of a preliminary model, a rough approximation is used. This approach uses benchmark data on pricing relative to costs from Southern Africa and other international studies (Box 1) and makes assumptions concerning the level of competition and relative influence of stakeholders, with and without reforms. This approach uses costs calculated for the industry as an input, and an assumed profitability percent, which is dependent on reforms being proposed and their ability to foster competition in the transport market which would lower this percentage.

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Box 1: Impact of Reform on Transport Prices from France

One study in France shows that truck transport costs fell by 33 percent between 1978 and 1998, with substantial regional variation due to differences in the quality of roads and the charges for road use. The main contributors were the deregulation of the trucking industry (-21.8 percentage points) and lower vehicle costs (-10.9 percentage points). Transport infrastructure (-3.2 percentage points) and declining fuel costs (-2.8 percentage points) were much less important.

IMPORT/EXPORT PRICES, TRADE AND GDP

One of the most important effects expected of reform is the indirect impact on trade arising from lower transport costs to the final user\(^{47}\). But those effects are complex. As the World Bank (2009b) points out, when transport costs fall, physical geography matters less. But with economies of scale in production, economic geography matters more. A decline in transport costs—with increasing returns to scale—generally means more spatial concentration of production. However, recent thinking in economics has emphasized the importance of transport costs in development where high transport costs inhibit economies of scale and support inefficient production. When transport costs fall, spatial differences in production and economic growth will increase, both within and between countries (World Bank 2009b, 170). This means that falling transport costs increase both long distance trade and trade between neighbors as relatively small differences in products lead to more trade between countries producing similar products.

In addition, falling transport costs and transit times frequently cause change in the structure of the local economy as trade in intermediate goods increases relative to final goods. Intra-industry trade in intermediate goods requires an especially efficient transport sector. The ability to coordinate and control production processes in real time by computerized systems has been central to the vertical disintegration of production processes in high-income countries and outsourcing to medium-income countries. So lower transport costs, changes in goods traded, and lower communication costs reinforce each other (World Bank 2009b, 182).

In West Africa, with its low-income countries, these structural effects will be less pronounced until the landlocked countries become more industrialized and achieve higher average income per capita. So modeling these effects is not so important relative to modeling the effects of transport costs on prices of imports and exports, which lead to increased demand and supply and increased trade.

The modeling of trade impacts must be carried out at the macroeconomic level. Three types of macroeconomic models have been used for this purpose: gravity, CGE, and price elasticity. Gravity models have shown strong linkages between generalized transport costs and trade levels in Africa.\(^{48}\) But they do not examine before and after linkages, which are best for predicting impacts. CGE models are good for describing the relationships between economic sectors in an economy or a region and they keep track of price effects and changes in demand and supply for different sectors. They are frequently used for impact studies on changes in trade tariffs and nontariff barriers. They do not take into account structural changes in sectors\(^{49}\) or price changes for specific commodities. Price elasticity models are useful for impact analyses where transport prices can be related to the prices of import or export goods.

A recent use of CGE models by Zaki (2011) shows substantial potential for increases in manufacturing exports and regional trade due to increased trade facilitation and trade

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\(^{47}\) These are called transport prices when paid by the shipper.

\(^{48}\) See, for example, Nathan Associates Inc. (2011).

\(^{49}\) CGE models are based on Social Accounting Matrix data for a given base year, which assumes sector structure remains constant, although the relative size of different sectors within the economy can change.
liberalization in sub-Saharan Africa, which overlaps with the types of reforms considered here. These results are indicative of the impacts expected for trade but are not directly transferable.

For the purpose of this preliminary model, we selected a simplified price elasticity approach for forecasting trade impacts based on the study of African countries by Jones (2008). The study results are applied to a rough breakdown of imports and exports into groupings for agricultural goods, minerals, fuel and other non-resource-related goods forecast for the landlocked countries in West Africa in 2015. (See Appendix D for details).

In the future it may be best to combine a price elasticity approach with CGE modeling in order to examine impacts on different economic sectors in a more thorough manner. This would take advantage of the effects of price changes as they affect different economic sectors and could also model increased economic activity due to transport cost reductions.\(^5^0\)

**PRODUCE AND CONSUMER SURPLUS**

Producers and consumers gain value due to savings in the prices of goods and the increase in their surplus (net value) of the increase in production and consumption. The modeling of price changes is straightforward once the portions of price changes passed on by shippers to producers or consumers are taken into account.

Producer and consumer surplus can be modeled by the assumption that the demand curve for consumers and the supply curve for producers is essentially linear for the small changes in volumes forecast in this model. This allows us to calculate consumer or producer surplus by calculating the area of the triangle that has the increase in volume as the base and the decrease in price as one side. This area is one half of the product of the decrease in price and the increase in volume.\(^5^1\)

**AXLE LOAD IMPACT ON ROAD MAINTENANCE AND REPAIR COSTS**

Enforcement of axle load regulations is not a liberalization reform but such reforms will influence truckers’ adherence to these regulations. This will be primarily due to the effect of shifting to more formal sector operators who don’t overload as much or as often as informal sector operators.

Many studies in West Africa and elsewhere show the effects of overloading on roads and some studies describe the economic benefit of eliminating overloading, providing data suitable for impact analysis.\(^5^2\) In Eastern and Southern Africa the total cost of overloading is estimated at

\(^{50}\) Regional studies for West Africa use CGE analysis and social accounting matrices.

\(^{51}\) See Mishan (1982) or other references on consumer and producer surplus estimation. This is a simplification that assumes that other prices do not change, but it is commonly used in transport economics.

\(^{52}\) See Fekpe and Oduro-Konadu (1993) for a list and also Vision Consult, Ltd. (2011)
more than US$4 billion per year (Pinard 2010).\(^{53}\) Even if the cost in West African corridors is 1/10 as much, it would reach US$400 million per year.

The modeling approach is at a meso level utilizing data on the incidence of truck overloading within each type of operation and for different truck sizes, relating this to each transit corridor and then to the countries responsible for the corridor road maintenance. This impact will be assessed for two cases, with and without effective enforcement of the axle load regulations, using data from Southern Africa on the impact of enforcement.

It should be noted that truck overloading is also related to higher accident rates, with associated social costs that are not included in the preliminary model (Pinard 2010 and 2011, 11).

**NON-TRUCKING INDUSTRY EMPLOYMENT IMPACTS**

As noted in Chapter 3, non-trucking employment impacts come from the indirect effects of changes in trucking industry employment plus the indirect effects of increased trade on employment. These indirect effects are best modeled at the macro level, using a multiplier approach, which can be derived from analysis of CGE models or the social accounting matrices (SAMs) on which they are based. For the purpose of preliminary modeling, multiplier data from other studies and other countries can be used. (See Appendix D for specific assumptions.)

**PRELIMINARY IMPACT MODEL**

As mentioned above, a preliminary impact model was created for this report and for use in analyzing policy impact. This model is in the form of an Excel workbook generally following the structure presented in Chapter 3 and the approaches presented above for each model component. This model focuses on the eight countries that either generate or accommodate a significant amount of transit traffic in West Africa (i.e., Benin, Burkina Faso, Côte d’Ivoire, Ghana, Mali, Niger, Senegal and Togo).\(^{54}\) The focus of the model is on transit trucking, but the expected side benefits for domestic trucking are also calculated.

**Data and Assumptions**

The data and assumptions used to create this preliminary model are documented in Appendix D.

**Examples of Model Input and Output Screens**

Five user interface screens from the preliminary impact model are shown in Figures 4-1 through 4-5. These are

- A scenario summary screen
- A key assumptions screen
- A country summary impact screen
- A trucking industry impacts screen

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\(^{53}\) Another estimate by the TRL (1991) estimated the cost of overloading to be some 1 to 2 percent of GNP in Africa.

\(^{54}\) The other countries impacts would benefit almost entirely through domestic trucking improvements and related impacts.
A household impacts screen

These screens are from an Excel workbook with separate tabs for different screens. The Excel format limits customizing the interface, but the major advantage is that users will likely be familiar with navigation in these screens.

The scenario summary screen (Figure 4-1) allows inputs to specify the scenario name and the types of reform being analyzed by country. It also gives a summary of all major impacts calculated in the preliminary model.

The key assumptions screen (Figure 4-2) summarizes reforms by corridor and allows the user to input key assumptions that define the scenario. This includes six important assumptions about the reforms and other data that define the impacts, and transit shares and formal sector shares by corridor, with and without the reforms.

Figure 4-3, the country summary screen, provides summary impact data by country. Figures 4-4a and 4-4b show the critical transport industry summary screen, which contains the base data for impacts on the transport sector and its components (domestic, transit, formal and informal sectors). This screen scrolls down to reveal more detailed assumptions that govern the impacts on the transport industry in the eight countries (as indicated in Figure 4-4b).

Finally, Figure 4-5 shows an example of the impact analysis for stakeholders, which in this case is the household or consumer sector in each country. There are similar screens for shippers (which include importers and exporters), producers, and trade impact forecasts in the preliminary model.
Figure 4-1
Example of a Scenario Summary Interface Screen for the Preliminary Model

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reform(s) Included</td>
<td>Benin</td>
</tr>
<tr>
<td>Truck Fleet Restriction (International only)</td>
<td>Y</td>
</tr>
<tr>
<td>Fleet Modernization Incentive (Int'l only)</td>
<td>Y</td>
</tr>
<tr>
<td>Eliminate Quotas</td>
<td>Y</td>
</tr>
<tr>
<td>Eliminate Queuing</td>
<td>N/A</td>
</tr>
<tr>
<td>Allow Cabotage Trucking</td>
<td>Y</td>
</tr>
<tr>
<td>Reduce Border and Checkpoint Delays</td>
<td>Y</td>
</tr>
<tr>
<td>Reduce Informal Payments</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>West African Regional Impacts</th>
<th>Total</th>
<th>West African Regional Impacts</th>
<th>Total</th>
<th>West African Regional Impacts</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Transit Demand (mil. ton-km)</td>
<td>2,025</td>
<td>Subsidies for Truck Purchases (US$ mil.)</td>
<td>74.5</td>
<td>Impacts on Economy (US$ mil.)</td>
<td>66.9</td>
</tr>
<tr>
<td>Change in Active Transit Fleet</td>
<td>-5,050</td>
<td>Subsidies for Interest Rates on Truck Purchases</td>
<td>7.0</td>
<td>Savings for Shippers (US$ mil.)</td>
<td>92.2</td>
</tr>
<tr>
<td>Change in Transit Operating Costs (US$ mil.)</td>
<td>20.0</td>
<td>Change in Road Maintenance/Repair Costs-min.</td>
<td>228.1</td>
<td>Increased Consumer Surplus (US$ mil.)</td>
<td>95.0</td>
</tr>
<tr>
<td>Change in Revenues from Shippers (US$ mil.)</td>
<td>68.2</td>
<td>Change in Road Maintenance/Repair Costs-max.</td>
<td>331.7</td>
<td>Increased Producer Surplus (US$ mil.)</td>
<td>59.0</td>
</tr>
<tr>
<td>Change in Trucker Net Income (US$ mil.)</td>
<td>48.2</td>
<td>Net Change for Government-min. (US$ mil.)</td>
<td>142.2</td>
<td>Total Benefit to Economy (US$ mil.)</td>
<td>436.9</td>
</tr>
<tr>
<td>Change in Employment from Greater Efficiency</td>
<td>-15,000</td>
<td>Net Change for Government-max. (US$ mil.)</td>
<td>249.8</td>
<td>Minimum (US$ mil.)</td>
<td>544.5</td>
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<tr>
<td>Change in Employment from Increased Demand</td>
<td>13,900</td>
<td>Transit Unit Costs and Prices</td>
<td>122.0</td>
<td>Value of Increased Trade (US$ mil.)</td>
<td>1,222</td>
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<tr>
<td>Net change in Trucking Employment</td>
<td>-1,100</td>
<td>Average Price per ton-km (US$)</td>
<td>0.088</td>
<td>Change in Employment due to Trade</td>
<td>104,000</td>
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<tr>
<td>Increase in Share of Formal Sector</td>
<td>61%</td>
<td>Average VOC per ton-km (US$)</td>
<td>0.071</td>
<td>Minimum</td>
<td>628,000</td>
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Impact Estimation Tool (Preliminary Version - 2015 estimated data)
Figure 4-2
Example of a Key Assumptions Interface Screen for the Preliminary Impact Model

<table>
<thead>
<tr>
<th>Key Assumptions Related to Reforms and Impacts</th>
<th>Corridor</th>
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<tbody>
<tr>
<td>Scenario: Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</td>
<td></td>
</tr>
<tr>
<td>5 Truck Fleet Quality Licensing (Int'l only)</td>
<td>Y</td>
</tr>
<tr>
<td>6 Fleet Modernization Incentives (Int'l only)</td>
<td>Y</td>
</tr>
<tr>
<td>7 Eliminate Quotas</td>
<td>Y</td>
</tr>
<tr>
<td>8 Eliminate Queuing</td>
<td>Y</td>
</tr>
<tr>
<td>9 Allow Cabotage Trucking</td>
<td>Y</td>
</tr>
<tr>
<td>10 Reduce Checkpoints and Border Times</td>
<td>Y</td>
</tr>
<tr>
<td>Key Impact Assumptions</td>
<td>Percent Subsidy for Truck Purchase: 20%</td>
</tr>
<tr>
<td>Percent Fleet Replacement per year due to Subsidy: 25%</td>
<td>Average Extra Load for Overloaded Trucks: 28%</td>
</tr>
<tr>
<td>Increase in Load Factor due to Cabotage operations on backhaul trips: 10%</td>
<td>Percent Reduction in Informal Payments: 90%</td>
</tr>
<tr>
<td>Checkpoints are reduced to three for coastal countries and two for landlocked countries. Border crossing times average 2 hours.</td>
<td></td>
</tr>
<tr>
<td>Percent Transit Share After Reform for:</td>
<td>Landlocked Countries</td>
</tr>
<tr>
<td>16 Percent Transit Share After Reform for:</td>
<td>80%</td>
</tr>
<tr>
<td>17 Coastal Countries</td>
<td>20%</td>
</tr>
<tr>
<td>18 Percent Formal</td>
<td>Landlocked</td>
</tr>
<tr>
<td>19 Coastal</td>
<td>Without reforms</td>
</tr>
<tr>
<td>20 Percent Sector</td>
<td>Landlocked</td>
</tr>
<tr>
<td>21 Coastal</td>
<td>Without reforms</td>
</tr>
<tr>
<td>22 Change in Annual km for Transit Trucks</td>
<td>Increased Annual km Due to Reduction in Checkpoints and Border Times: 20,000</td>
</tr>
</tbody>
</table>
### Figure 4-3
Example of a Country Impact Summary Interface Screen for the Preliminary Impact Model

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
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<tbody>
<tr>
<td><strong>Impacts by Country</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>Scenario:</strong> Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</td>
<td></td>
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<td></td>
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<tr>
<td><strong>Impacts on Transit Trucking Industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in Share of Formal Sector</td>
<td>65%</td>
<td>65%</td>
<td>50%</td>
<td>50%</td>
<td>65%</td>
<td>65%</td>
<td>65%</td>
<td>65%</td>
<td>65%</td>
<td>61%</td>
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<tr>
<td>Change in Size of Active Transit Fleet</td>
<td>(200)</td>
<td>(1,300)</td>
<td>70</td>
<td>(500)</td>
<td>(1,400)</td>
<td>(1,200)</td>
<td>(20)</td>
<td>(500)</td>
<td>(15,000)</td>
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<tr>
<td>Change in Employment from Greater Efficiency</td>
<td>(700)</td>
<td>(3,900)</td>
<td>(100)</td>
<td>(1,300)</td>
<td>(3,900)</td>
<td>(3,200)</td>
<td>(200)</td>
<td>(1,700)</td>
<td>(15,000)</td>
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</tr>
<tr>
<td>Change in Employment from Increased Demand</td>
<td>1,300</td>
<td>2,500</td>
<td>100</td>
<td>3,200</td>
<td>2,000</td>
<td>1,700</td>
<td>2,400</td>
<td>700</td>
<td>13,000</td>
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</tr>
<tr>
<td>Net change in Trucking Employment</td>
<td>600</td>
<td>(1,400)</td>
<td>-</td>
<td>1,900</td>
<td>(1,900)</td>
<td>(1,500)</td>
<td>2,200</td>
<td>(1,000)</td>
<td>(1,100)</td>
<td></td>
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</tr>
<tr>
<td><strong>Impacts on Transit Trucking Operators</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Change in Demand for Transit (mil. ton-km)</td>
<td>214</td>
<td>806</td>
<td>578</td>
<td>321</td>
<td>566</td>
<td>315</td>
<td>179</td>
<td>383</td>
<td>3,362</td>
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<tr>
<td>Change in Transit Operating Costs (US$ mil.)</td>
<td>-</td>
<td>(2.9)</td>
<td>21.2</td>
<td>(3.0)</td>
<td>(12.5)</td>
<td>11.1</td>
<td>6.4</td>
<td>(0.3)</td>
<td>20.0</td>
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</tr>
<tr>
<td>Change in Informal Payments (US$ mil.)</td>
<td>(2.1)</td>
<td>(8.8)</td>
<td>(2.5)</td>
<td>(2.0)</td>
<td>(9.7)</td>
<td>(2.6)</td>
<td>(0.7)</td>
<td>(3.1)</td>
<td>(31.5)</td>
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<td>Change in Transit Revenues (US$ mil.)</td>
<td>(0.5)</td>
<td>7.7</td>
<td>26.3</td>
<td>7.3</td>
<td>1.0</td>
<td>(2.1)</td>
<td>9.5</td>
<td>19.0</td>
<td>68.2</td>
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<td>Net Change for Transit Truckers</td>
<td>1.6</td>
<td>19.4</td>
<td>7.6</td>
<td>12.3</td>
<td>23.2</td>
<td>(10.6)</td>
<td>3.8</td>
<td>22.4</td>
<td>79.7</td>
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<tr>
<td><strong>Impacts on Government (US$ mil.)</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Subsidies for Truck Purchases</td>
<td>4.7</td>
<td>19.1</td>
<td>4.2</td>
<td>6.4</td>
<td>17.1</td>
<td>12.1</td>
<td>2</td>
<td>8.9</td>
<td>74.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidies for Interest Rates on Truck Purchases</td>
<td>0.7</td>
<td>2.7</td>
<td>0.6</td>
<td>0.9</td>
<td>2.4</td>
<td>1.7</td>
<td>0.3</td>
<td>1.2</td>
<td>10.5</td>
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<tr>
<td>Change in Road Maintenance/Repair Costs - min.</td>
<td>43.7</td>
<td>63.2</td>
<td>13.3</td>
<td>12.8</td>
<td>38.5</td>
<td>12.3</td>
<td>19.4</td>
<td>20.9</td>
<td>224.1</td>
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<td>Change in Road Maintenance/Repair Costs - max.</td>
<td>65.5</td>
<td>94.9</td>
<td>17.7</td>
<td>17.1</td>
<td>57.7</td>
<td>18.4</td>
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<td>331.7</td>
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<td>Net Change for Government - min. (US$ mil.)</td>
<td>38.3</td>
<td>41.4</td>
<td>8.5</td>
<td>5.5</td>
<td>19.0</td>
<td>-1.5</td>
<td>17.1</td>
<td>10.8</td>
<td>139.1</td>
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<td></td>
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<tr>
<td>Net Change for Government - max. (US$ mil.)</td>
<td>60.1</td>
<td>73.1</td>
<td>12.9</td>
<td>9.8</td>
<td>38.2</td>
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<td>26.8</td>
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<td>246.7</td>
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<tr>
<td><strong>Impacts on Economy (US$ mil.)</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Savings to Shippers (US$ mil.)</td>
<td>11.2</td>
<td>24.3</td>
<td>-15</td>
<td>5.3</td>
<td>28</td>
<td>20.5</td>
<td>-5.5</td>
<td>-1.5</td>
<td>66.9</td>
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<td></td>
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<tr>
<td>Increase in Consumer Surplus (US$ mil.)</td>
<td>6.2</td>
<td>31.3</td>
<td>4.3</td>
<td>5.7</td>
<td>27.2</td>
<td>11.4</td>
<td>1.1</td>
<td>5</td>
<td>92.2</td>
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</tbody>
</table>
### Figure 4-4a
Example of a Trucking Industry Impact Interface Screen for the Preliminary Impact Model (Upper Part of Work Sheet)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trucking Industry - 2015</strong></td>
<td><strong>Scenario:</strong> Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Change with Reforms</strong></td>
<td><strong>Benin</strong></td>
<td><strong>Burkina Faso</strong></td>
<td><strong>Cote d’Ivoire</strong></td>
<td><strong>Ghana</strong></td>
<td><strong>Mali</strong></td>
<td><strong>Niger</strong></td>
<td><strong>Senegal</strong></td>
<td><strong>Togo</strong></td>
<td><strong>Benin</strong></td>
<td><strong>Burkina Faso</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Demand</td>
<td>1,337</td>
<td>4,701</td>
<td>3,391</td>
<td>20,520</td>
<td>8,189</td>
<td>2,874</td>
<td>1,379</td>
<td>4,225</td>
<td>1,101</td>
<td>4,808</td>
<td>3,058</td>
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<tr>
<td>Domestic Cabotage</td>
<td>1,337</td>
<td>107</td>
<td>327</td>
<td>121</td>
<td>123</td>
<td>290</td>
<td>171</td>
<td>35</td>
<td>168</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Transit Imports</td>
<td>1,951</td>
<td>1,049</td>
<td>2,872</td>
<td>1,078</td>
<td>1,115</td>
<td>2,604</td>
<td>1,664</td>
<td>315</td>
<td>1,498</td>
<td>944</td>
<td>2,413</td>
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<tr>
<td>Transit Exports</td>
<td>74</td>
<td>18</td>
<td>398</td>
<td>130</td>
<td>113</td>
<td>299</td>
<td>44</td>
<td>34</td>
<td>127</td>
<td>16</td>
<td>178</td>
<td></td>
</tr>
<tr>
<td>Fleet Size Domestic-Formal</td>
<td>(500)</td>
<td>1,100</td>
<td>1,500</td>
<td>6,000</td>
<td>5,000</td>
<td>1,200</td>
<td>600</td>
<td>1,900</td>
<td>400</td>
<td>1,100</td>
<td>1,700</td>
<td></td>
</tr>
<tr>
<td>Fleet Size Domestic-Formal</td>
<td>6,580</td>
<td>590</td>
<td>2,300</td>
<td>520</td>
<td>800</td>
<td>2,070</td>
<td>1,400</td>
<td>240</td>
<td>1,080</td>
<td>120</td>
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<tr>
<td>Fleet Size Domestic-Formal</td>
<td>(4,000)</td>
<td>1,000</td>
<td>6,400</td>
<td>16,700</td>
<td>17,200</td>
<td>6,300</td>
<td>3,400</td>
<td>10,800</td>
<td>2,000</td>
<td>6,100</td>
<td>9,200</td>
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<tr>
<td>Total Heavy Goods Trucks</td>
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<td>7,890</td>
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<td>23,400</td>
<td>21,270</td>
<td>10,350</td>
<td>8,030</td>
<td>13,040</td>
<td>3,890</td>
<td>8,520</td>
<td>17,960</td>
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<tr>
<td>Total Operating Costs (US$ m)</td>
<td>25.9</td>
<td>80.5</td>
<td>80.8</td>
<td>531.0</td>
<td>166.0</td>
<td>58.5</td>
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<td>92.7</td>
<td>21.6</td>
<td>82.5</td>
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<td>Costs with Domestic-Formal</td>
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<td>50.9</td>
<td>195.3</td>
<td>52.2</td>
<td>59.1</td>
<td>72.5</td>
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<td>177.2</td>
<td>532.6</td>
<td>81.6</td>
<td>258.8</td>
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<td>Overload effects (US$ m) Total</td>
<td>-496.4</td>
<td>133.2</td>
<td>40.6</td>
<td>13.9</td>
<td>15.0</td>
<td>27.7</td>
<td>26.9</td>
<td>4.4</td>
<td>21.1</td>
<td>55.0</td>
<td>170.6</td>
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<tr>
<td>Total Quota Transfer Payments (US$ m)</td>
<td>411.6</td>
<td>519.6</td>
<td>580.2</td>
<td>1,738.7</td>
<td>960.6</td>
<td>470.0</td>
<td>328.8</td>
<td>466.3</td>
<td>202.7</td>
<td>440.5</td>
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<td>-91.3</td>
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<td>0.8</td>
<td>5.4</td>
<td>1.2</td>
<td>0.8</td>
<td>0.3</td>
<td>1.2</td>
<td>0.2</td>
<td>6.4</td>
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<tr>
<td>Quota Transfer Payments (US$ m) (1/3 of Niger imports)</td>
<td>-29.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
<td>-</td>
<td>0.1</td>
<td>2.0</td>
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### Figure 4-4b
Example of a Trucking Industry Impact Interface Screen for the Preliminary Impact Model (Middle of Work Sheet)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
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<td><strong>Trucking Industry - 2015</strong></td>
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<tr>
<td>Scenario:</td>
<td>Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</td>
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</tr>
<tr>
<td>13</td>
<td>Informal</td>
<td>Domestic</td>
<td>-91.1</td>
<td>0.7</td>
<td>0.8</td>
<td>5.4</td>
<td>1.2</td>
<td>0.8</td>
<td>0.3</td>
<td>1.2</td>
<td>0.2</td>
<td>6.4</td>
</tr>
<tr>
<td>20</td>
<td>Payments</td>
<td>Transit-Formal Sector</td>
<td>-2.4</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.9</td>
<td>0.3</td>
<td>0.1</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>21</td>
<td>(US$ mil.)</td>
<td>Transit-Informal Sector</td>
<td>-25.1</td>
<td>-</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
<td>-</td>
<td>0.1</td>
<td>2.0</td>
</tr>
<tr>
<td>22</td>
<td>Quota Transfer Payments (US$ mil.) (1/3 of Niger Imports)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Total Transit Operating Costs (including quota transfers)</td>
<td>12.1</td>
<td>64.2</td>
<td>196.1</td>
<td>66.0</td>
<td>73.1</td>
<td>178.4</td>
<td>122.4</td>
<td>21.0</td>
<td>99.5</td>
<td>69.8</td>
<td>199.0</td>
</tr>
<tr>
<td>24</td>
<td>Transit Operating Costs per ton-km</td>
<td>-21.3%</td>
<td>0.055</td>
<td>0.055</td>
<td>0.050</td>
<td>0.054</td>
<td>0.056</td>
<td>0.065</td>
<td>0.055</td>
<td>0.056</td>
<td>0.073</td>
<td>0.071</td>
</tr>
<tr>
<td>25</td>
<td>Transit Price per ton-km (import direction)</td>
<td>-20.4%</td>
<td>0.080</td>
<td>0.086</td>
<td>0.066</td>
<td>0.087</td>
<td>0.087</td>
<td>0.080</td>
<td>0.087</td>
<td>0.080</td>
<td>0.100</td>
<td>0.088</td>
</tr>
<tr>
<td>26</td>
<td>Total Transit Revenues (US$ mil.)</td>
<td>6.8%</td>
<td>95.3</td>
<td>241.7</td>
<td>89.2</td>
<td>93.9</td>
<td>221.8</td>
<td>153.9</td>
<td>26.7</td>
<td>145.8</td>
<td>95.8</td>
<td>234.0</td>
</tr>
<tr>
<td>27</td>
<td>Total Transport Costs (US$ mil.)</td>
<td>495.7</td>
<td>515.6</td>
<td>580.2</td>
<td>1,738.7</td>
<td>960.6</td>
<td>470.0</td>
<td>328.8</td>
<td>466.3</td>
<td>202.7</td>
<td>455.1</td>
<td>535.5</td>
</tr>
<tr>
<td>28</td>
<td>Total Transport Revenues (US$ mil.)</td>
<td>-75.98</td>
<td>565.4</td>
<td>608.1</td>
<td>2,076.6</td>
<td>994.7</td>
<td>537.9</td>
<td>305.8</td>
<td>492.6</td>
<td>266.9</td>
<td>576.6</td>
<td>654.4</td>
</tr>
<tr>
<td>29</td>
<td>Total Net Transport Revenues</td>
<td>-485.69</td>
<td>45.8</td>
<td>27.3</td>
<td>337.9</td>
<td>34.1</td>
<td>67.9</td>
<td>23.2</td>
<td>26.3</td>
<td>64.2</td>
<td>121.5</td>
<td>99.5</td>
</tr>
<tr>
<td>30</td>
<td>Trucking Direct Employment</td>
<td>(1,216)</td>
<td>11,824</td>
<td>17,280</td>
<td>37,091</td>
<td>32,247</td>
<td>14,816</td>
<td>10,413</td>
<td>17,578</td>
<td>5,410</td>
<td>11,212</td>
<td>18,659</td>
</tr>
<tr>
<td>31</td>
<td>Trucking Direct and Indirect Employment</td>
<td>(2,068)</td>
<td>20,101</td>
<td>29,576</td>
<td>63,055</td>
<td>54,819</td>
<td>25,158</td>
<td>17,702</td>
<td>30,563</td>
<td>9,197</td>
<td>19,060</td>
<td>31,720</td>
</tr>
<tr>
<td>32</td>
<td>Assumptions</td>
<td>With Reforms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Percent Demand</td>
<td>Formal Sector - International</td>
<td>61%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>15%</td>
</tr>
<tr>
<td>34</td>
<td>Carried by</td>
<td>Informal Sector - International</td>
<td>-61%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>85%</td>
</tr>
<tr>
<td>35</td>
<td>Percent</td>
<td>Formal Sector - Domestic</td>
<td>-80%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>15%</td>
</tr>
<tr>
<td>36</td>
<td>Overloading</td>
<td>Formal Sector - International</td>
<td>-100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>30%</td>
</tr>
<tr>
<td>37</td>
<td>Informal Sector - Domestic</td>
<td>-85%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>20%</td>
</tr>
<tr>
<td>38</td>
<td>Informal Sector - International</td>
<td>-95%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>40%</td>
</tr>
</tbody>
</table>
### Figure 4-5
Example of a Household Impact Interface Screen for the Preliminary Impact Model

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
<td>I</td>
<td>J</td>
</tr>
<tr>
<td>2</td>
<td>Household Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scenario: Maximum Reform Package - with 97% axle load enforcement - No change in share of landlocked vs coastal operators - Scenario 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Total Change with Reforms</td>
<td>Benin</td>
<td>Burkina Faso</td>
<td>Cote d’Ivoire</td>
<td>Ghana</td>
<td>Mali</td>
<td>Niger</td>
<td>Senegal</td>
<td>Togo</td>
</tr>
<tr>
<td>5</td>
<td>Change in Price of Consumer Goods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Domestic (US$ mil.)</td>
<td>-4.6</td>
<td>-0.3</td>
<td>-1.2</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-1.0</td>
<td>-0.6</td>
<td>-0.1</td>
<td>-0.6</td>
</tr>
<tr>
<td>7</td>
<td>Transit Imports (US$ mil.)</td>
<td>-58.9</td>
<td>-5.9</td>
<td>-15.6</td>
<td>-3.9</td>
<td>-5.3</td>
<td>-13.3</td>
<td>-9.5</td>
<td>-1.0</td>
<td>-4.4</td>
</tr>
<tr>
<td>8</td>
<td>Total (US$ mil.)</td>
<td>-63.5</td>
<td>-6.2</td>
<td>-16.8</td>
<td>-4.3</td>
<td>-5.7</td>
<td>-14.3</td>
<td>-10.1</td>
<td>-1.1</td>
<td>-5.0</td>
</tr>
<tr>
<td>9</td>
<td>Consumer Surplus due to Trade Increase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Transit Imports (US$ mil.)</td>
<td></td>
<td>28.7</td>
<td>n/a</td>
<td>14.3</td>
<td>n/a</td>
<td>n/a</td>
<td>12.9</td>
<td>1.3</td>
<td>n/a</td>
</tr>
<tr>
<td>11</td>
<td>Total Impact on Consumer Surplus</td>
<td></td>
<td>92.2</td>
<td>6.2</td>
<td>31.3</td>
<td>4.3</td>
<td>5.7</td>
<td>27.2</td>
<td>11.4</td>
<td>1.1</td>
</tr>
<tr>
<td>12</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td>Assumptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Percent Transport Price Change Passed on to Consumers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40%</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Results of Pilot Data Collection

Data for this study were first collected through a pilot survey carried out for Benin and Niger and for the Cotonou-Niamey corridor as described in Nathan Associates Inc. (2012). Data were collected on

- Trucking industry structure, operations and fleet
- Industry practices (including vehicle loading and overloading, informal payments, etc.)
- Regulations and their enforcement
- Freight transport costs and prices
- Transport and transit demand.

Focus group discussions generated some suggestions on reforms supported by stakeholders in Niger and on potential areas of resistance to reform, which are summarized below.

KEY DATA FOR PRELIMINARY MODEL ESTIMATION

Data collected in the field covered (1) demand data for trade flows from Niger along different corridors, (2) fleet composition and ownership by type of operator, (3) vehicle operating costs, and (4) transit pricing. These data are summarized in the following tables, except for vehicle operating cost data, which are analyzed in Appendix D. Of commodity types, petroleum fuel and uranium ore exports are considered “strategic” and allocated exclusively to Nigerien truckers. Other products are subject to 1/3 to 2/3 quota rules.

With some six hundred operators, the freight transport sector in Niger operated a fleet of approximately 18,740 vehicles in 2010 as follows:

- 5 carriers with fleets of 50 to 100 trucks
- 25 transporters operating fleets of 10 to 50 trucks
- The rest with fleets of between 1 and 9 trucks.

The estimated fleet composition by size of truck is presented in Table 5-2. Transit fleets are dominated by large and very large trucks. Domestic transport is primarily carried out with low capacity trucks (3-10 tons) with some medium trucks of 25 to 30 tons capacity and a few semi-trailers carrying mixed transport.
Table 5-1
Evolution of Nigerien Import and Export Flows by Type, 2005-2010, Road only (000 tons)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td>398</td>
<td>332</td>
<td>334</td>
<td>308</td>
<td></td>
</tr>
<tr>
<td>Food products</td>
<td>293</td>
<td>340</td>
<td>384</td>
<td>537</td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td>106</td>
<td>131</td>
<td>183</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Construction materials</td>
<td>175</td>
<td>175</td>
<td>154</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>Fuels</td>
<td>161</td>
<td>140</td>
<td>169</td>
<td>171</td>
<td></td>
</tr>
<tr>
<td>Chemicals</td>
<td>76</td>
<td>61</td>
<td>74</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Other products</td>
<td>137</td>
<td></td>
<td>206</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>Total imports</td>
<td>1,346</td>
<td>1,333</td>
<td>1,504</td>
<td>1,690</td>
<td>1,584</td>
</tr>
<tr>
<td><strong>Uranium Mining Sector</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk transport*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Fuel imports</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Containers</td>
<td></td>
<td></td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total exports</td>
<td>61</td>
<td>187</td>
<td>179</td>
<td>135</td>
<td>82</td>
</tr>
</tbody>
</table>

*NOTE: Bulk exports: AREVA forecasts production of uranium concentrates to rise to 5,000 tons by 2015. * mostly domestic

*SOURCE: CNUT and AREVA.

Figure 5-1
Percentage Imports to Niger by Corridor/Origin Country in 2010
Table 5-2
Composition of the Vehicle Fleets Used by Domestic and Transit Operators in Niger (% of fleet)

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Domestic Operators</th>
<th>Transit Operators</th>
<th>Total Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small trucks (3-10 tons)</td>
<td>36%</td>
<td>0%</td>
<td>11%</td>
</tr>
<tr>
<td>Medium-sized trucks (25-30 tons)</td>
<td>52%</td>
<td>1%</td>
<td>17%</td>
</tr>
<tr>
<td>Large trucks (35-40 tons)</td>
<td>12%</td>
<td>99%</td>
<td>72%</td>
</tr>
<tr>
<td>Very large trucks (45-51 tons)</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Source:* Analysis of registration data and interviews with truckers’ associations.

Table 5-3
Percent of Registered Trucks used by Formal and Informal Sector Operators and Own-Account Operators in Niger

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Common Carriers</th>
<th>Own-Account Carriers</th>
<th>Total Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Formal</td>
<td>Informal</td>
<td></td>
</tr>
<tr>
<td>Small trucks (3-10 tons)</td>
<td>2%</td>
<td>98%</td>
<td>1%</td>
</tr>
<tr>
<td>Medium-sized trucks (15-30 tons)</td>
<td>5%</td>
<td>95%</td>
<td>3%</td>
</tr>
<tr>
<td>Large trucks (35-40 tons)</td>
<td>70%</td>
<td>30%</td>
<td>7%</td>
</tr>
<tr>
<td>Very large trucks (45-51 tons)</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Note:* Own-account carriers are a subset of the formal sector.

*Source:* Analysis of registration data and interviews with truckers’ associations.

Official statistics in Table 5-4 suggest that additions to the heavy goods fleet in Niger from 2006-2010 are replacing the fleet and compensating for older vehicles going out of service. But these statistics are incomplete and, where available, inaccurate, despite some adjustment in how they
were calculated in 2006. They are supposed to account for vehicles going out of service but do not effectively do this, since there is currently a higher turnover of older vehicles than the method seems to account for. Therefore, a reduced estimate of 9,500 trucks is taken in this report as the estimated fleet size in Niger in 2010 (Table 5-5). This number still overstates the active heavy goods vehicle fleet, which has been estimated to be on the order of 2,000 trucks.

**Table 5-4**
*New Registrations of Heavy Goods Vehicles in Niger, 2006-2009*

<table>
<thead>
<tr>
<th>Types</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer and semi-trailer trucks</td>
<td>1,292</td>
<td>1,224</td>
<td>n/a</td>
<td>1,624</td>
</tr>
<tr>
<td>Regular trucks</td>
<td>614</td>
<td>753</td>
<td>n/a</td>
<td>631</td>
</tr>
<tr>
<td>Total</td>
<td>1,306</td>
<td>1,977</td>
<td>n/a</td>
<td>8,000</td>
</tr>
</tbody>
</table>


**Table 5-5**
*Heavy Goods Vehicle Fleet in Niger, 2006-2009*

<table>
<thead>
<tr>
<th>Types</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer and semi-trailer trucks</td>
<td>4,712</td>
<td>6,024</td>
<td>7,429</td>
<td>9,053</td>
<td>n/a</td>
</tr>
<tr>
<td>Regular trucks</td>
<td>1,649</td>
<td>2,402</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>6,361</td>
<td>8,426</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Adjusted total</td>
<td>6,361</td>
<td>7,300</td>
<td>n/a</td>
<td>9,200</td>
<td>9,500</td>
</tr>
</tbody>
</table>

*Note: The adjusted total is based on growth of transit demand and replacement of older fleet.*


The fleet average age is very high (Table 5-6), which means the Nigerien fleet was much older than those in other countries in 2007. This is changing as newer vehicles are purchased; the average age of the fleet is now reported to be 17 years, rather than 23 years or more. This age is still overstated in the statistics as noted above.

The mileage for Niger truckers is very low (Table 5-7), especially for transit truckers, due to long wait times at the port of Cotonou and other factors.

For the different types of truck operators, there is a substantial variation in the cost of the trucks purchased in Niger (Table 5-8). According to our interviews, used trucks from Nigeria are popular because of their low cost, but their quality and serviceability is also lower than other imported trucks.
Table 5-6
Composition of the Nigerien Heavy Goods Fleet by Type and Age in 2010

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Tractors (%)</th>
<th>Semi-Trailers (%)</th>
<th>Regular Trucks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>0.8</td>
<td>1.15</td>
<td>7.41</td>
</tr>
<tr>
<td>5-10</td>
<td>1.4</td>
<td>1.35</td>
<td>3.00</td>
</tr>
<tr>
<td>10-15</td>
<td>12.9</td>
<td>2.63</td>
<td>4.87</td>
</tr>
<tr>
<td>15-20</td>
<td>35.1</td>
<td>10.99</td>
<td>18.16</td>
</tr>
<tr>
<td>20-25</td>
<td>25.8</td>
<td>21.24</td>
<td>18.89</td>
</tr>
<tr>
<td>35-30</td>
<td>15.9</td>
<td>28.86</td>
<td>22.17</td>
</tr>
<tr>
<td>30-35</td>
<td>5.6</td>
<td>19.76</td>
<td>10.95</td>
</tr>
<tr>
<td>&gt;=35</td>
<td>2.5</td>
<td>14.03</td>
<td>7.54</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Average Age</td>
<td>23 years</td>
<td>29 years</td>
<td>25 years</td>
</tr>
</tbody>
</table>

Source: DT/TMF. These data are based on registered vehicles and exclude vehicles which have gone out of service.

Table 5-7
Estimated Average Annual km for the Nigerien Heavy Goods Fleet by Operator Type in 2010

<table>
<thead>
<tr>
<th>Operator Type</th>
<th>Average Annual km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal Sector</td>
<td>37,500</td>
</tr>
<tr>
<td>Own-Account</td>
<td>37,500</td>
</tr>
<tr>
<td>Informal Sector</td>
<td>21,000</td>
</tr>
</tbody>
</table>

Source: Interviews in December 2011.

Table 5-8
Purchase Price of 40-ton Trucks in Niger for Different Operator Types

<table>
<thead>
<tr>
<th>Type of Operator</th>
<th>Purchase Type</th>
<th>Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal sector</td>
<td>New</td>
<td>120,000</td>
</tr>
<tr>
<td></td>
<td>Used</td>
<td>70,000</td>
</tr>
<tr>
<td>Own account</td>
<td>New</td>
<td>90,000</td>
</tr>
<tr>
<td></td>
<td>Used</td>
<td>30,000</td>
</tr>
<tr>
<td>Informal sector</td>
<td>Used</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Source: Interviews in December 2011.

Due to the poor condition of their fleet, most informal sector truckers struggle to compete for transit trade, despite the quota system (Table 5-9).
Table 5-9
Estimated Shares of Corridor Traffic by Country of Registration for Trucks in 2010

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Nigerien Truck (%)</th>
<th>Coastal Country (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotonou - Niamey</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>Lomé - Niamey</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>Tema - Niamey</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Abidjan - Niamey</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Nigeria - Niamey</td>
<td>10</td>
<td>90</td>
</tr>
</tbody>
</table>

Source: CNUT.

DATA NEEDED TO COMPLETE THE MODEL
Since data collected for this study focused on only two of the eight countries in the model we need to make some additional assumptions to estimate the data for the remaining countries (see Appendix D). These countries have different levels of regulations and enforcement and probably different business practices. Therefore, it is expected that additional data collection will be carried for those countries, and eventually for all countries in the region, in order to provide a comprehensive basis for estimating the impact of road transport liberalization in West Africa. To ensure compatibility, additional data should be collected using the same data definitions and instruments used in this study when possible.

The following data need further verification, especially in the six countries not surveyed for this study:

- Current fleet size and availability by type of operator
- Proportions of formal and informal operators by country
- Shares of transit traffic by country of registration
- Truck annual km
- Percent of imports designated “strategic” for quota purposes
- Percent enforcement of quota and queuing for “non-strategic” cargos
- Percent overloading of trucks.

Any differences in these data from the assumptions in this study (which are based on partial surveys) would help refine the results. Without these refinements, the model is only useful for order-of-magnitude analysis (although there is some potential for sensitivity analysis as discussed in Chapter 6).

INDUSTRY PRACTICES THAT WILL AFFECT REFORMS
According to shippers, the “tour de rôle” system is no longer used in Niger55 and shippers are free to choose their carriers within the limit of the 2/3-1/3 quota system supervised by the CNUT. They say that transporters from Niger no longer have to submit a “declaration of arrival” to the local representative of the Niger Freight Transporters Union at Cotonou port, which used to be in

55 Since the promulgation of Order No. 09 \ MT \ DTT-MF of 13/02/2007 which removes this queuing by stipulating that “the importer is allowed to carry his goods by his own truck or by any Nigerien carrier of their choice with a truck registered in Niger.”
charge of running the queuing system on the basis of this declaration and the “first come-first loaded” principle.

The transporters’ union believes that removing the quota system will induce the disappearance of the freight industry in Niger because it can’t compete with foreign carriers. Niger’s fleet is very old and transporters face many other constraints, such as

- The diversion of Nigerien traffic to the benefit of Beninois carriers;
- Difficulty accessing the port of Cotonou;
- Excessive access charges at Cotonou port (50,000 to 100,000 FCFA or US$100-200 per trip);
- CNUT’s weak capacity to enforce compliance with the quota distribution.

From the Nigerien transporters’ point of view, the prices fixed by their union are only a reference and prices are negotiated between the carrier and the shipper’s representatives, depending on the nature of the cargo, the period of the year, etc. They consider that prices are liberalized and that because of the strong competition between transporters, especially those from Benin, they are obliged to accept prices with very low margins.

According to the operators, the issues of Cotonou port access (2 to 3 weeks of waiting time) and incidental payments (100,000 FCFA or US$ 200 per trip) do not allow an informal carrier to control its own expenses and to properly determine the right price. On the other hand, due to the very old truck ages, low speed and bad conditions, they are limited to one rotation by per month, while at least two are necessary to make their business profitable and generate a sufficient cash flow for fleet renewal.

Meanwhile, the Union of Importers and Exporters claims that the transporters’ union is artificially keeping prices high (e.g., “goods of first necessity” must be carried at higher prices than other goods).

**SUGGESTIONS FOR REFORM**

Nigerien truckers suggested the following reforms:

- Improve access to the port by removing discrimination at the entrance
- Maintain roads and invest effectively in new road infrastructure
- Establish axle load control at the port and not on the road
- Provide support and incentives for fleet renewal
- Strengthen security for persons and goods at the port of Cotonou and along the corridor
- Establish a single window at Cotonou to facilitate formalities
- Increase the grace period in the port from 9 to 30 days
- Increase the loading time from the current 72 hours
- Establish contractual relationship based on precise and signed contracts between shippers or their representatives and carriers
- Develop an information system (freight stock exchange) for the arrival of cargo
- Make the escort effective and available in time
- Remove checkpoints
• Respect bilateral and international transportation agreements.

AREAS OF POTENTIAL RESISTANCE TO REFORM
As noted, the transporters’ union believes that the removal of the quota system will induce the disappearance of the freight industry in Niger because it can’t compete with foreign carriers. This is the basis of potential resistance to reform.
6. Estimates of Potential Impact of Reforms and Liberalization

In this chapter we describe reforms and actions that could liberalize road transport in West Africa and their potential impact. We do not attempt a full analysis of these reforms but simply describe their potential effects on the industry and the economy of West Africa and estimate the order of magnitude of these impacts, where possible. A more detailed analysis and modeling effort will be needed to refine these results (see Chapter 7). In this chapter we report on the results of two scenarios:

1. Maximum Impact Scenario without any change in the current shares of landlocked country and coastal country haulage in each corridor.

2. Maximum Impact Scenario with changes in the shares of haulage by coastal and landlocked countries to favor countries with the lowest transport costs.

Both scenarios are evaluated under the assumption that the axle load enforcement program agreed by UEMOA is fully implemented and dramatically reduces overloading, as demonstrated in Southern Africa. This aspect of the scenarios reinforces the impact of creating a more professional trucking industry and the shift toward a larger share for formal sector operators. It also puts pressure on prices to rise from current levels and this increase will be significant if the suggested transport reforms are not carried out.

Only West African countries with significant transit tonnages are analyzed in the preliminary model: Benin, Burkina Faso, Côte d’Ivoire, Ghana, Mali, Niger, Senegal, and Togo.

REFORMS TO ENCOURAGE MODERNIZATION AND PROFESSIONALISM

As noted earlier, eliminating restrictive practices in road transport gives rise to competition that reduces tariffs, induces fleet efficiency, and moves trucking operators toward more modern fleets and professional operations. The four types of reform identified in Chapter 3 are analyzed here under both scenarios as a package. These are:

- Elimination of quotas and queuing (including restrictions on cabotage)
- Restrictive or quality licensing of vehicles and drivers

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56 See Terevaninthorn and Raballand (2008) and Arvis et al. (2010).
57 See Arvis et al. (2010) pages 105-106.
• Tax incentives to modernize fleets
• Minimizing of border formalities and road checkpoints.

To estimate maximum impact, we analyze the package rather than individual effects. Reforms are assumed to be in place by 2015, since they would take time to implement and actions and enforcement would take a period of years to be effective. The use of a single future reference year (2015) simplifies analysis consistent with the objectives of this preliminary study. (A detailed analysis of a realistic implementation time frame is recommended for later research.)

Key assumptions concerning reforms under the two scenarios are summarized in Table 6-1 and spelled out below:

• All reforms are implemented in all eight countries simultaneously by 2015.
• Checkpoints on transit corridors are reduced to three in coastal countries and two in landlocked countries and average border crossing times are reduced to two hours.
• Incentives to modernize transit fleets are provided as 20 percent subsidies on new truck purchases and 20 percent subsidy of interest rates on these purchases. This results in an adoption rate of 25 percent of the transit fleet for each year, until the fleet is wholly modernized.
• The incentives to modernize the fleet are reinforced by requiring all transit traffic to be hauled by qualified trucks and drivers (quality licensing).
• The enforcement of axle load regulations leads to an overloading rate of 3 percent for all trucks except formal sector trucks engaged in transit that are assumed to have 0 percent overloading. The average overload is assumed to be 14 tons for trucks with overloading.
• There is some spillover of these reforms to the domestic trucking sector, where the percentage of formal sector trucking is assumed to increase even though they will not benefit from the vehicle purchase subsidies.

Table 6-1

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck fleet quality licensing for transit</td>
<td>All countries</td>
<td>All countries</td>
</tr>
<tr>
<td>Truck fleet modernization incentives</td>
<td>All countries</td>
<td>All countries</td>
</tr>
<tr>
<td>Elimination of quotas and queuing</td>
<td>All countries where applicable</td>
<td>All countries where applicable</td>
</tr>
<tr>
<td>Cabotage trucking allowed</td>
<td>All countries</td>
<td>All countries</td>
</tr>
<tr>
<td>Checkpoints and border procedures and delays substantially reduced</td>
<td>All countries</td>
<td>All countries</td>
</tr>
<tr>
<td>Percent truck overload limits enforced(^a)</td>
<td>97%</td>
<td>97%</td>
</tr>
<tr>
<td>Level of fleet modernization subsidies</td>
<td>20% of truck purchase price and interest</td>
<td>20% of truck purchase price and interest</td>
</tr>
<tr>
<td>Percent transit fleet replacement per year due to subsidies and reforms</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Average increase in load factor for transit trucks due to cabotage</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Percent reduction in informal payments and checkpoints</td>
<td>90%</td>
<td>90%</td>
</tr>
</tbody>
</table>
### Assumption Table

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent reduction in payments for quota transfers</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Percent reduction in truck overloading</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Shares of transit traffic for landlocked and coastal countries</td>
<td>Same as 2011</td>
<td>Increased shares for transit fleets with lower costs (Benin, Côte d'Ivoire, Togo)</td>
</tr>
</tbody>
</table>

\[ a \] This assumption is independent of trucking industry liberalization reforms, but is included as a major uncertainty which affects the level of reform impacts.

### ESTIMATES OF IMPACTS OF REFORM ON THE ROAD TRANSPORT INDUSTRY

For purposes of this study the direct impacts of these reforms are assumed to be in effect in a designated year (2015). As stated above, more detailed analysis of the effects over time, as well as other refinements, are recommended for later research.

#### Business Practices and Industry Structure

As discussed earlier, reforms are expected to have the following impact on business practices:

- Reduction of waiting times in queues to get loads in favor of direct contracting or contracting through cargo brokers
- Restriction of transit transport to operators, drivers and vehicles with modern, professional certification
- Provision of either direct subsidies or reduced import tariffs for modern truck purchases and/or subsidized loans for truck purchases
- Reduction of waiting times at borders and checkpoints
- Reduction of informal payments by truckers
- Increases in cabotage trucking by transit operators from corridor countries

In addition there will be indirect effects that cause

- An increase in the proportion of formal trucking operators (to 80 percent of transit trucks)
- An increase in the proportion of larger trucks (as transit operators trade up with new purchases)
- A related decrease in the percent of overloaded vehicles\(^{58}\)
- An increase in the annual mileage for trucks engaged in transit of 20,000 km per year due to lesser wait times at checkpoints and borders\(^{59}\)
- An increase in load factors by 10 percent for transit trucks due to cabotage operations

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\(^{58}\) Overloaded vehicles will also be reduced through increased enforcement of the axle load regulations, independent of the liberalization of road transport. This is evaluated as a scenario for impact analysis.

\(^{59}\) Up to a maximum of 100,000 km per year. Only the Côte d'Ivoire trucks are affected by this cap.
These changes in business practices are expected to change industry structure for truckers engaged in transit cargo shipping (Table 6-2). A demonstration effect on domestic truckers is also expected as the number of formal sector trucking operators increases, which will also increase efficiency and reduce trucking prices for domestic trucking, but to a lesser extent as discussed below.

Table 6-2
Changes in the Structure of the Transit Trucking Industry, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Impact</th>
<th>Scenario</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Côte d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in number of trucks in active transit fleet</td>
<td>1</td>
<td>-100</td>
<td>-900</td>
<td>-70</td>
<td>-400</td>
<td>-900</td>
<td>-600</td>
<td>-80</td>
<td>-400</td>
<td>-3,450</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>90</td>
<td>-1,400</td>
<td>600</td>
<td>-400</td>
<td>-1,500</td>
<td>-800</td>
<td>70</td>
<td>-400</td>
<td>-3,740</td>
</tr>
<tr>
<td>Percent formal operators after reform</td>
<td>1</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Change in employment due to increased efficiency</td>
<td>1</td>
<td>-300</td>
<td>-2,900</td>
<td>-300</td>
<td>-1,200</td>
<td>-3,000</td>
<td>-1,800</td>
<td>-300</td>
<td>-1,400</td>
<td>-11,200</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-600</td>
<td>-1,800</td>
<td>-1,100</td>
<td>-1,200</td>
<td>-1,600</td>
<td>-1,100</td>
<td>-500</td>
<td>-1,400</td>
<td>-9,300</td>
</tr>
<tr>
<td>Change in employment due to increased demand</td>
<td>1</td>
<td>500</td>
<td>100</td>
<td>200</td>
<td>200</td>
<td>-</td>
<td>200</td>
<td>1900</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>500</td>
<td>-1,100</td>
<td>1,500</td>
<td>200</td>
<td>-1,500</td>
<td>600</td>
<td>500</td>
<td>200</td>
<td>-300</td>
</tr>
<tr>
<td>Net change in trucking employment</td>
<td>1</td>
<td>-200</td>
<td>-2,400</td>
<td>-200</td>
<td>-1,000</td>
<td>-2,400</td>
<td>-1,600</td>
<td>-300</td>
<td>-1,200</td>
<td>-9,700</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-100</td>
<td>-2,900</td>
<td>400</td>
<td>-1,000</td>
<td>-3,100</td>
<td>-500</td>
<td>-1,200</td>
<td>-9,000</td>
<td></td>
</tr>
</tbody>
</table>

Note: The “percent of formal operators after reform” impact is based on an input assumption.

The number of trucks in the transit trucking fleets is expected to decline with reforms under both scenarios by about 3,500 vehicles or 14 percent of the 25,000 vehicle fleet. This will lead to a decrease in direct trucking industry employment of 9,000 to 11,000 jobs, a loss partly compensated for by 1,900 new jobs created by rising demand for transport in Scenario 1 (but not Scenario 2) due to the trade effects of reforms. There is a net loss of about 9,000 trucking jobs in both scenarios. (This is more than compensated by a larger job increase in other sectors from increased trade as discussed below.)

There is a significant difference in impact between countries. The landlocked countries of Burkina Faso, Mali, and Niger will lose more trucking jobs than the coastal countries, and among the coastal countries, Ghana and Togo will have greater losses due to their greater improvements over present inefficient operations. Under Scenario 2 there are even small net increases in transit trucking jobs for Côte d’Ivoire, and Benin and Senegal are close to break-even as they increase their share of transit operations. (Note that landlocked countries have greater gains in other sectors compared with coastal countries.)

60 The greater share of freight carried by more efficient operators in Scenario 2 eliminates the job creation impact of more transport demand.
Transit Demand and Productivity

Transit Demand
Total transit demand is expected to increase due to increased trade by 19 percent or 2,100 million ton-km in both scenarios (Table 6-3). The change in demand is spread across all country operators more or less equally in Scenario 1, but in Scenario 2 the increases are concentrated in countries with lower cost operators (Benin, Cote d’Ivoire, and Senegal) and there is expected to be a net 22 percent decrease in demand for Mali (in favor of Côte d’Ivoire) and a smaller net decrease in Burkina Faso and Niger.

Table 6-3
Changes in the Demand, Costs and Revenues for the Transit Trucking Industry, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Scenario</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in demand for transit (mil. ton-km)</td>
<td>1</td>
<td>165</td>
<td>508</td>
<td>152</td>
<td>198</td>
<td>575</td>
<td>180</td>
<td>45</td>
<td>270</td>
<td>2,093</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>531</td>
<td>-276</td>
<td>1,813</td>
<td>199</td>
<td>-574</td>
<td>-127</td>
<td>298</td>
<td>271</td>
<td>2,135</td>
</tr>
</tbody>
</table>

Productivity
Productivity can improve when queuing is eliminated and quality licensing is instituted (Box 2). The impact of these measures will be muted somewhat by West Africa’s trade imbalances but can still be significant (Table 6-4). Only Côte d’Ivoire is expected to achieve levels of productivity found in Southern Africa for formal sector operators. However, increases in mileage of 55-125 percent are expected for Mali, Niger, Senegal, and Ghana, while the other countries can expect increases of 25 percent to 50 percent.

Box 2: Impact of Reform on Truck Productivity in Jordan
In 2008, Jordan’s government decided to eliminate first come, first served queuing and change to quality licensing for transport from the port of Aqaba, replacing the traditional system with a notification system that allows approved and licensed truckers to operate out of the port only when they have cleared entry requirements. Aqaba port handles a large amount of transit traffic. Before the change trucks averaged 30,000 km per year. Now they average 100,000 km per year and carry a 30 percent increase in traffic with a much reduced truck fleet and better service.

SOURCE: Arvis et al. (2010).

Table 6-4
Estimated Average Annual Km for Transit Trucks with and without Reforms, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Formal Sector</th>
<th>Informal Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without Reform</td>
<td>With Reform</td>
</tr>
<tr>
<td>Benin</td>
<td>78,000</td>
<td>98,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>45,000</td>
<td>69,000</td>
</tr>
<tr>
<td>Cote d’Ivoire</td>
<td>87,000</td>
<td>110,000</td>
</tr>
<tr>
<td>Ghana</td>
<td>45,000</td>
<td>73,000</td>
</tr>
<tr>
<td>Mali</td>
<td>45,000</td>
<td>70,000</td>
</tr>
<tr>
<td>Niger</td>
<td>37,000</td>
<td>64,000</td>
</tr>
<tr>
<td>Senegal</td>
<td>45,000</td>
<td>72,000</td>
</tr>
<tr>
<td>Togo</td>
<td>52,000</td>
<td>77,000</td>
</tr>
</tbody>
</table>
Operating Costs and Revenue of Transit Trucking Industry

Net transport revenue after costs for transit truck operators calculated in the preliminary model for eight countries in West Africa is estimated to increase by about US$40-US$60 million with the reforms for the target year of 2015 for Scenarios 1 and 2 (Table 6-5). This includes the combined effects of increased productivity, lower unit operating costs and increased revenue from increased demand and from cabotage operations. This is a conservative estimate of total benefits to truckers in the region due to the reforms.61

All countries except Benin and Niger gain net revenue under Scenario 1, with Burkina Faso and Mali gaining the most. In Scenario 2, all countries except Niger and Mali have net gains for their trucking sectors. Niger loses a significant amount of net revenues and Mali almost breaks even even in Scenario 2.

Table 6-5
Changes in Operating Costs and Revenue for Transit Trucking in West Africa, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Impact</th>
<th>Scenario</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in transit operating costs (US$ mil.)</td>
<td>1</td>
<td>1.5</td>
<td>-18.1</td>
<td>-</td>
<td>-13.0</td>
<td>-13.5</td>
<td>5.0</td>
<td>-1.1</td>
<td>-6.9</td>
<td>-46.7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>23.2</td>
<td>-71.6</td>
<td>83.8</td>
<td>-13.3</td>
<td>-80.3</td>
<td>-16.7</td>
<td>12.5</td>
<td>-16.6</td>
<td>-69.0</td>
</tr>
<tr>
<td>Change in informal payments (US$ mil.)</td>
<td>1</td>
<td>-1.7</td>
<td>-6.9</td>
<td>-2.5</td>
<td>-1.8</td>
<td>-7.7</td>
<td>-1.5</td>
<td>-0.5</td>
<td>-2.7</td>
<td>-25.3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-1.6</td>
<td>-7.2</td>
<td>-2.0</td>
<td>-1.8</td>
<td>-8.1</td>
<td>-1.6</td>
<td>-0.6</td>
<td>-2.7</td>
<td>-25.6</td>
</tr>
<tr>
<td>Change in transit revenue (US$ mil.)</td>
<td>1</td>
<td>-5.6</td>
<td>-7.7</td>
<td>-4.3</td>
<td>-4.2</td>
<td>-1.8</td>
<td>-2.9</td>
<td>-0.1</td>
<td>-4.1</td>
<td>-33.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>23.9</td>
<td>-65.3</td>
<td>116.4</td>
<td>-4.5</td>
<td>-89.4</td>
<td>-28.7</td>
<td>18.7</td>
<td>1.3</td>
<td>55.3</td>
</tr>
<tr>
<td>Net benefit for transit truckers (US$ mil.)</td>
<td>1</td>
<td>-5.4</td>
<td>17.3</td>
<td>-1.8</td>
<td>10.6</td>
<td>19.4</td>
<td>-6.4</td>
<td>2.1</td>
<td>5.4</td>
<td>41.2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.3</td>
<td>13.5</td>
<td>34.6</td>
<td>10.6</td>
<td>-1.0</td>
<td>-10.4</td>
<td>6.8</td>
<td>5.2</td>
<td>61.6</td>
</tr>
</tbody>
</table>

The average unit transport cost savings with reform is expected to be 1.6 US cents/ton-km or 21 percent for both scenarios. Truckers in most countries may experience savings of 15 percent-24 percent as shown in Table 6-6, although these savings can vary + 20 percent within the range of uncertainty of this model.

---

61 This does not include the expected smaller amount spin-off savings for the domestic market due to the expected demonstration effect of industry structure changes for all truckers. The spin-off savings on domestic trucking costs is expected to affect between 1/10 and 1/3 of the domestic truckers.
Table 6-6
Estimated Transport Cost Savings per ton-km for Transit Truckers by Country, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Impact</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Wt. Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average unit operating costs (US$/ton-km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before reform</td>
<td>0.071</td>
<td>0.076</td>
<td>0.060</td>
<td>0.081</td>
<td>0.078</td>
<td>0.083</td>
<td>0.077</td>
<td>0.076</td>
<td>0.075</td>
</tr>
<tr>
<td>After reform</td>
<td>0.059</td>
<td>0.058</td>
<td>0.051</td>
<td>0.059</td>
<td>0.060</td>
<td>0.070</td>
<td>0.056</td>
<td>0.060</td>
<td>0.059</td>
</tr>
<tr>
<td>Savings in unit operating costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount (US$/ton-km)</td>
<td>0.012</td>
<td>0.018</td>
<td>0.009</td>
<td>0.022</td>
<td>0.018</td>
<td>0.013</td>
<td>0.016</td>
<td>0.016</td>
<td>0.016</td>
</tr>
<tr>
<td>Percent</td>
<td>17</td>
<td>24</td>
<td>15</td>
<td>27</td>
<td>23</td>
<td>15</td>
<td>21</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

Transport Pricing
The average transport price savings with reform is also expected to be 1.8 US cents/ton-km for these two scenarios or 19 percent overall. Shippers in individual countries may experience savings of 17-21 percent as shown in Table 6-7. These differences are not significant and within the range of uncertainty of the model, and are due mostly to minor changes in assumptions on pricing.

This level of price reduction is consistent with experience in Laos and Thailand, where quota elimination lowered tariffs by 20 percent to 30 percent. The dominant operator remained dominant, but shippers could use other carriers and this gave them power to negotiate lower tariffs.62

Table 6-7
Estimated Transport Price Savings per ton-km for Transit Truckers by Country, Scenarios 1 and 2

<table>
<thead>
<tr>
<th>Impact</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Wt. Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average unit transport prices (US$/ton-km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before reform</td>
<td>0.099</td>
<td>0.091</td>
<td>0.092</td>
<td>0.092</td>
<td>0.094</td>
<td>0.100</td>
<td>0.094</td>
<td>0.096</td>
<td>0.093</td>
</tr>
<tr>
<td>After reform</td>
<td>0.080</td>
<td>0.072</td>
<td>0.073</td>
<td>0.073</td>
<td>0.074</td>
<td>0.083</td>
<td>0.074</td>
<td>0.077</td>
<td>0.075</td>
</tr>
<tr>
<td>Savings in unit transport prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount (US$/ton-km)</td>
<td>0.019</td>
<td>0.019</td>
<td>0.019</td>
<td>0.019</td>
<td>0.020</td>
<td>0.017</td>
<td>0.020</td>
<td>0.021</td>
<td>0.018</td>
</tr>
<tr>
<td>Percent</td>
<td>20</td>
<td>21</td>
<td>20</td>
<td>20</td>
<td>21</td>
<td>17</td>
<td>21</td>
<td>21</td>
<td>19</td>
</tr>
</tbody>
</table>

NOTE: The average includes discounts for backhaul.

This level of reduction is also consistent with the experience of liberalization of road transport in Rwanda in 1994 as cited by Terevaninthorn and Raballand. Prices there fell more than 30 percent in nominal terms and almost 75 percent in real terms, taking into account the increase in prices of

inputs. This level of reduction overstates the potential impact in West Africa due to special circumstances, but provides a pertinent upper bound reference point.

**IMPACT ON GOVERNMENTS**

The impacts on governments calculated in the preliminary model are only for expenditures. There are expected benefits in the form of import and export duties from increased trade and also decreases in income from reduced license fees, etc., that are not included in this model and are expected to be less important than the impacts on expenditures shown below.

**Expenditures to Support Reforms**

The expenditures to support the reforms are not fully included in the preliminary model. Only expenditures for subsidizing truck purchases and interest charges on truck purchases are calculated (Table 6-8). These are significant in the case of Scenarios 1 and 2 and amount to about US$70 million in either scenario, based on an expected renewal of 25 percent of the transit fleet under these subsidy programs per year in the initial years, including 2015 (Table 6-8). These expenditures vary by country according to the size of the active transit fleet registered in that country to which the subsidy program applies under each scenario.

**Table 6-8**

*Estimated Impacts on Government Expenditures Due to the Reforms in 2015 (US$ mil.)*

<table>
<thead>
<tr>
<th>Impact</th>
<th>Scenario</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidies for vehicle purchases and interest</td>
<td>1</td>
<td>5.5</td>
<td>13.7</td>
<td>3.4</td>
<td>7.2</td>
<td>18.4</td>
<td>9.8</td>
<td>1.4</td>
<td>9.6</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7.2</td>
<td>13.9</td>
<td>9.0</td>
<td>7.2</td>
<td>11.9</td>
<td>7.8</td>
<td>2.9</td>
<td>9.6</td>
<td>70.5</td>
</tr>
<tr>
<td>Low est. of savings in road maintenance and repair</td>
<td>1 and 2</td>
<td>40.7</td>
<td>59.0</td>
<td>12.4</td>
<td>11.9</td>
<td>35.9</td>
<td>11.5</td>
<td>18.1</td>
<td>19.5</td>
<td>209.0</td>
</tr>
<tr>
<td>High est. of savings in road maintenance and repair</td>
<td>1 and 2</td>
<td>61.1</td>
<td>88.5</td>
<td>16.8</td>
<td>16.2</td>
<td>53.9</td>
<td>17.2</td>
<td>27.1</td>
<td>29.2</td>
<td>310.0</td>
</tr>
<tr>
<td>Low est. of net impact on expenditures</td>
<td>1</td>
<td>35.2</td>
<td>39.3</td>
<td>9.0</td>
<td>4.7</td>
<td>17.5</td>
<td>1.7</td>
<td>16.7</td>
<td>9.9</td>
<td>134.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>33.5</td>
<td>44.1</td>
<td>3.4</td>
<td>4.7</td>
<td>24.0</td>
<td>3.7</td>
<td>15.2</td>
<td>9.9</td>
<td>138.5</td>
</tr>
<tr>
<td>High est. of net impact on expenditures</td>
<td>1</td>
<td>55.6</td>
<td>68.8</td>
<td>13.4</td>
<td>9.0</td>
<td>35.5</td>
<td>7.4</td>
<td>25.7</td>
<td>19.6</td>
<td>235.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>53.9</td>
<td>73.6</td>
<td>7.8</td>
<td>9.0</td>
<td>42.0</td>
<td>9.4</td>
<td>24.2</td>
<td>19.6</td>
<td>239.5</td>
</tr>
</tbody>
</table>

**Expenditures for Road Maintenance and Repair**

There will be significant impacts on government expenditure for road maintenance and repair associated with reduced axle loads. Research in West Africa on this issue supports a calculation of reduced costs in the preliminary model, as described in Appendix D. As indicated in Table 6-8 these savings are very significant under both scenarios and amount to a low estimate of about US$210 million and a high estimate of about US$310 million per year. The road maintenance

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63 Terevaninthorn and Raballand (2008), page 23. There was only a state-controlled transport operation in Rwanda with monopoly powers and the civil war also disrupted transport and increased prices.
savings could easily cover the subsidies of vehicle fleet renewal and they will continue into the future.

**IMPACT ON THE REGIONAL ECONOMY**

The preliminary model estimates three types of impacts: (1) impacts on net benefits for shippers, consumers and producers, (2) increases in the value of trade, and (3) impacts on employment.

**Shippers, Consumers, and Producers**

Approximately US$110 million in economic benefits is provided to regional consumers, with shippers and producers also receiving about half of this benefit. Landlocked countries benefit the most—enjoying additional trade and producer and consumer price savings for transit—while other country’s producers and consumers benefit only from the savings in cabotage transport prices. Total benefits to the regional economy are on the order of US$400 to US$500 million, when the trucking industry and government net benefits are added in. About one-third of the benefits to the regional economy are due to the reduction in truck overloading and the rest to the other industry reforms.

**Table 6-9**

Estimated Benefits to Shippers, Producers and Consumers by Country, Scenarios 1 and 2 in 2015 (US$ millions)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net economic benefits for shippers</td>
<td>0.3</td>
<td>8.7</td>
<td>0.3</td>
<td>0.4</td>
<td>17.6</td>
<td>13.4</td>
<td>0.1</td>
<td>0.5</td>
<td>41.3</td>
</tr>
<tr>
<td>Net economic benefits for consumers</td>
<td>0.6</td>
<td>41.6</td>
<td>0.5</td>
<td>0.7</td>
<td>38.6</td>
<td>26.6</td>
<td>0.1</td>
<td>1.0</td>
<td>109.7</td>
</tr>
<tr>
<td>Net economic benefits for producers</td>
<td>0.2</td>
<td>25.1</td>
<td>0.1</td>
<td>0.2</td>
<td>27.0</td>
<td>12.9</td>
<td>-</td>
<td>0.2</td>
<td>65.7</td>
</tr>
<tr>
<td>Low est. of net economic benefits for regional economy $a$</td>
<td>30.9</td>
<td>132.0</td>
<td>8.1</td>
<td>16.6</td>
<td>120.1</td>
<td>48.2</td>
<td>19.0</td>
<td>17.0</td>
<td>391.9</td>
</tr>
<tr>
<td>High est. of net economic benefit for regional economy $a$</td>
<td>51.3</td>
<td>161.5</td>
<td>12.5</td>
<td>20.9</td>
<td>138.1</td>
<td>53.9</td>
<td>28.0</td>
<td>26.7</td>
<td>492.9</td>
</tr>
</tbody>
</table>

*a Including net economic benefits for the trucking industry and the government.

**Trade**

High transport/logistics costs paid by importers and exporters and the unreliability of the transport/logistics system depress trade. This includes transport tariffs paid by importers and exporters and high logistics costs paid by importers and exporters as described above.
Increased competition and efficiency in the road transport industry due to reform and liberalization will decrease transport tariffs, increase reliability and predictability, decrease logistics costs and, ultimately, expand trade. More reliable transport service and lower tariffs will also facilitate the integration of local companies into global supply chains. Trade gains are obtained by combining trade creation and trade substitution effects. Since transport inefficiencies are more important for imports, they would be most affected initially and the analysis will mostly focus on the project impact on imports. Nevertheless, improvement of corridor efficiency would affect exports as well as imports in the region. Increased import volumes would benefit local consumers (including local companies relying on foreign inputs) by increasing their consumer surplus but it may also create a loss for some local manufacturers, whose products could be replaced by cheaper imports. However, increased export volume would benefit local producers by opening market opportunities. Overall, trade creation effects are expected to be much larger than trade substitution effects (World Bank 2008, 96-97).

High prices for the transport of imports and exports are a form of nontariff barrier (NTB) to trade. There has been a substantial amount of research on the impact of reducing NTBs around the world, including in some African countries.64

The increases in trade to landlocked countries forecast in this preliminary model amount to US$1.0 billion (Table 6-10). These are related primarily to responses to price changes which result in an increase in demand for imports and an increase in supply of exports (see Appendix D for the detailed assumptions). This is a conservative estimate since it does not take into account the general improvement in logistics service which will result from these reforms. The improved logistics systems may be an equally effective catalyst for increased trade as the lower costs.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Côte d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in value of trade</td>
<td>-</td>
<td>380</td>
<td>-</td>
<td>-</td>
<td>380</td>
<td>240</td>
<td>-</td>
<td>-</td>
<td>1,000</td>
</tr>
</tbody>
</table>

On the other hand, if transport prices are not allowed to fall under the influence of market pressures, there will be much less influence on trade, although a continuation of past relative modest growth is likely (and included in the model), even with restraints on competition. This scenario would have less benefit for the region and policies should be targeted to avoid it.

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64 See for example Ferrantino (2010).
INDIRECT IMPACT ON EMPLOYMENT

The preliminary model calculates two types of indirect impact on employment: (1) indirect effects of direct employment changes in the trucking industry, and (2) the indirect effects on employment related to the increase in trade.

Indirect Impacts of Trucking on Employment

A multiplier of 1.5 was estimated for trucking industry employment, which means that each ten jobs in the trucking industry generates another five jobs in other related sectors, as income earned in trucking is spent in the local economy, and the trucking industry buys materials and services for its operations. This also works in reverse when the trucking industry contracts as it becomes efficient; that will reduce the related indirect employment as indicated in Table 6-11. Scenarios 1 and 2 indicate a loss of about 16,000 trucking jobs in the region, a loss more than compensated for by trade-related jobs in these scenarios (see below).

Table 6-11
Indirect Employment Impacts for Trucking and Trade Changes due to Reforms

<table>
<thead>
<tr>
<th>Impact</th>
<th>Scenario</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Cote d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct and indirect employment changes for trucking industry</td>
<td>1</td>
<td>-300</td>
<td>-4,100</td>
<td>-400</td>
<td>-1,700</td>
<td>-4,100</td>
<td>-2,700</td>
<td>-500</td>
<td>-2,100</td>
<td>-15,900</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-200</td>
<td>-5,000</td>
<td>700</td>
<td>-1,700</td>
<td>-5,300</td>
<td>-2,900</td>
<td>-</td>
<td>-2,100</td>
<td>-16,500</td>
</tr>
<tr>
<td>Low estimate of employment impact from increased trade</td>
<td>1 &amp; 2</td>
<td>-</td>
<td>60,000</td>
<td>-</td>
<td>60,000</td>
<td>40,000</td>
<td>-</td>
<td>-</td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>High estimate of employment impact from increased trade</td>
<td>1 &amp; 2</td>
<td>-</td>
<td>220,000</td>
<td>-</td>
<td>280,000</td>
<td>170,000</td>
<td>-</td>
<td>-</td>
<td>670,000</td>
<td></td>
</tr>
</tbody>
</table>

Indirect Employment Impacts of Increased Trade

Trade increases have a variety of employment impacts. For imports of consumer goods there are retail jobs, delivery and distribution jobs and import service jobs and their multipliers. For intermediate goods and exports there are distribution and logistics jobs, processing and related services with their multipliers. Some research has been done in West Africa in this area as described in Appendix D, and the resulting multipliers were used to calculate low and high estimates of the impacts as shown in Table 6-11.

What is clear from this table is that even by our low estimate trade impacts on employment more than compensate for losses in trucking-related industries. The trade effects are an order of magnitude larger than the trucking employment effects.
Most of the trade-related employment impacts are found in the landlocked countries and these would be very significant. Under Scenario 2, some employment shifts to coastal countries with more efficient trucking operations, but the effect is small compared to trade-related employment.

OTHER INDIRECT IMPACTS

Shipper Logistics Costs
Reform of road transport (and transport and trade facilitation) is expected to reduce transit time and make freight shipment more reliable and predictable. Importers and exporters value time and reliability. Unreliable and unpredictable transport requires spending more on inventory, and more on communications and staff to smooth out transactions, while delayed deliveries cost sales and erode competitiveness.

The value of indirect economic benefits—outside of reduced costs for shippers, consumers, and producers for the transported goods and the employment impact discussed below—are not calculated in the preliminary model. However, there should be significant increases in activities in some sectors, such as manufacturing, induced by the change in transport costs as suggested by Zaki (2011).

Other Nonquantified Impacts
Nonquantified impacts are important but no data are available in the context of this project. These impacts include

- Rise in number of employees covered by the social security system
- Development of trucking-related industries
- Reduction in emissions by trucks due to fleet modernization
- Change in economic structure in both landlocked and coastal countries due to the impact of lower transport prices
- Reduction in shipper logistics costs due to lower transit time and greater reliability

These impacts deserve further research, a point elaborated on in Chapter 7.

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65 See Nathan (2011a), page 43.
7. Conclusions and Recommendations

Delaquis et al. (1994), among others, has pointed out that reforms that improve road freight transport could be very cost-effective\(^{67}\) in reducing road transport prices and provide a wide range of benefits for limited costs. This observation is confirmed in this report. These benefits and costs, however, affect stakeholders in different ways and to different extents.

PRELIMINARY MODEL

The preliminary model described in this report is a first step in creating a tool to analyze the impact of reform and liberalization of the trucking industry in West Africa. It is a very approximate analytic tool and depends on assumptions to fill gaps in the available data. It is useful in estimating the order of magnitude of potential impacts and can be used to test the sensitivity of certain assumptions on the principal results. It also gives clues as to the potential impacts on different stakeholders. This model can be easily updated with new data as it becomes available.

IMPACT RESULTS

The key results from this model in its present form are as follows:

- Reforms to the trucking industry in West Africa could generate US$400-US$500 million in net economic benefits.
- Reforms could reduce transport costs substantially, and lead to some countries approaching levels of efficiency found in Southern Africa.
- Reforms and their effects on pricing could increase transit trade by about 8 percent in value.
- These benefits will accrue primarily to the landlocked countries of Burkina Faso, Mali, and Niger, but also with some spin-off to the coastal countries.
- Significant benefits can be quantified for
  - Truckers
  - Shippers (including importers and exporters)
  - Consumers

\(^{67}\) Compared with infrastructure improvements.
— Producers
— Governments.

• The effects of axle load control can result in savings of US$200-US$300 million per year for road maintenance operations and these controls would be reinforced with trucking reforms that encourage formal sector trucking operations and higher levels of transport service along with a modernized fleet.

• The initial higher prices due to axle load controls would be counteracted and offset with trucking sector reforms that would eventually result in lower overall prices according to the preliminary model.

• Net benefits due to axle load controls account for 1/3 of the total net benefits to the regional economy and 2/3 due to other industry reforms.

• The gains in efficiency from improved trucking operations will result in somewhat lower employment in the trucking industry, losses are more than compensated for by the positive impact of increased trade and transport on cost and increases in the total net revenue of the trucking sector.

STAKEHOLDER IMPACTS (WINNERS AND LOSERS)
There are a variety of impacts on different stakeholders and for different countries and these can be explored with the preliminary model. It is clear from the model that the biggest winners among the stakeholders are

• Shippers, consumers, and producers in landlocked countries
• Government road maintenance agencies
• Formal sector truckers in all countries
• Informal sector truckers who can afford to modernize their fleets.

Freight brokers are expected to expand dramatically with the reforms. Smaller but positive gains are expected for

• Shippers, consumers, and producers in coastal countries
• Truckers in all countries except Niger, since the sector as a whole will have increased transit earnings with reforms.

The main losers are the informal sector truckers who cannot afford to modernize their fleets or who do not want to join the formal sector. This is particularly true for Nigerien truckers.

RESISTANCE TO REFORM
There will be substantial resistance to reform by informal sector truckers, particularly those from landlocked countries, and this resistance is rational. Truckers from landlocked countries also fear a biased system of freight allocation favoring the coastal countries. If reforms are to succeed, a transparent freight brokering system is needed and possibly compensation policies and other actions to counter resistance.
CONCLUSIONS AND RECOMMENDATIONS

RESISTANCE TO LOWER TRANSPORT PRICES
There may also be resistance to lower prices for transport by some stakeholders. This can create a critical problem since lower prices are needed to trigger additional trade growth. If transport prices are not allowed to fall under the influence of market pressures, there will be much less influence on trade, although a continuation of past relative modest growth is likely, even with restraints on competition. This scenario would have less benefit for the region and policies should be targeted to avoid it.

There may be a need for a campaign to educate stakeholders about the broader benefits of the reforms related to achieving additional growth and its benefits.

FUTURE ACTIONS
The preliminary model needs to be refined as soon as possible with the incorporation of more sophisticated modeling techniques, and its reliability improved with more data collection, as identified in this report. Meanwhile, the preliminary model is useful and we recommend continuing to run it until a more refined one is ready.

There appears to be sufficient evidence of the serious effects of inefficiencies in the West African freight transport industry and the benefits of reform to justify quickly developing reform packages for the transit industry in West Africa.
References


Zerelli, S. 2010. Comparative Analysis of Total Logistic Costs in the Northern Corridor Region. Northern Corridor Trade and Transit Coordination Authority.

Appendix A. Data Definitions

Terms in this report may be variously defined. To avoid confusion in interpretation of analysis and findings, we define terms below.

**Annual Mileage.** The total distance driven by a truck over a year, usually given in kilometers.

**Axle Load.** The weight recorded or specified as a maximum for a single axle or a group of linked axles for a truck.

**Backhaul.** The transport of goods by a trucker on a return trip from his principle haulage direction (usually imports to landlocked countries are the principle direction).

**Benchmarks.** Performance measures representing best practice or good developed country operations, productivity, costs or pricing efficiency.

**Cabotage.** The transport of goods by a truck registered outside a given country between two points in another country.

**Checkpoint.** An official or unofficial blockade which requires vehicles to stop en route along a corridor.

**Corridor.** A major transport link between two countries, often serving a seaport in one country and a major center in a landlocked country.

**Delay Time.** Time spent by a vehicle when not moving along a corridor. This includes delays waiting for cargo at the port, delays at checkpoints and delays at border crossings.

**Formal Operator.** Trucker who follows modern management practices and employs modern vehicles in his fleet.

**Heavy Goods Vehicle.** A truck, semi-trailer truck or truck and trailer combination capable of carrying more than 10 tons.

**Informal Operator.** Trucker who operates without formal management techniques and who relies on informal connections to carry out his business.

**Informal Payments.** Payments made to persons for facilitating transit cargo who do not have a legal reason to receive them. These include bribes to officials or unofficial checkpoint operators.
**Inland container terminal.** A terminal where containers are taken to be stuffed or stripped. These terminals can also serve as inland ports with customs facilities.

**Logistics chain.** A series of transportation/operational links and nodes through which freight and containers travel from origin to destination. A corridor represents a part of the logistics chains for importers and exporters.

**Own-account Operator.** Trucker who does not have a public transport company and who only operates a vehicle for transporting his own cargos.

**Port.** A seaport that contains at least one type of terminal, normally including a container terminal, a general cargo terminal and a bulk terminal for petroleum products.

**Price.** A logistics performance indicator, usually total price per container or per ton paid by the shipper for transiting a link or a node in a corridor from origin to destination.

**Quality Licensing.** A type of regulation of transport that requires vehicles and/or operators to meet certain standards before they are issued a license.

**Quota.** An official amount or share of cargo that is allocated to the truckers from a specified country.

**Queuing.** A requirement to take a turn in order of service to receive cargo (also called tour de rôle) or to pass through a checkpoint or border post. This is usually done on a first come-first served basis.

**Reliability.** A performance indicator reflecting the variability in transit times between origin and destination.

**Third country rule.** The prohibition of transport by a trucker registered in a given country from transporting goods between two other countries.

**Ton.** Metric ton (1,000 kg)

**Transit time.** A logistics performance indicator representing the time to pass through a link or a node in a corridor, from origin to destination excluding waiting time.

**Truck.** Road freight transport vehicle.

**Trucker.** Road freight transport vehicle operator.

**Vehicle Operating Cost (VOC).** The costs incurred for operating a truck in a corridor. These include fuel, maintenance, drivers’ salaries, depreciation and overhead. Fixed operating costs include depreciation and overhead. The rest are considered variable costs.

**Waiting time.** A performance indicator representing delay time for a shipment not spent in process or in actual movement along a corridor.
Appendix B. Regional Policy, Legal and Regulatory Framework

REGIONAL INSTITUTIONS
The two principal institutions that influence transport policy in the region and therefore have direct relevance to this study include the Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union (WAEMU or UEMOA in French). ECOWAS includes all West African states, while UEMOA membership only includes eight francophone states in West Africa.

ECOWAS
The Economic Community of West African States (ECOWAS)² is a regional group of fifteen countries³, founded in 1975. Its mission is to promote economic integration in "all fields of economic activity, particularly industry, transport, telecommunications, energy, agriculture, natural resources, commerce, monetary and financial questions, social and cultural matters ....." Several regional policy and legal instruments governing interstate transport and transit facilitation have been created under the auspices of ECOWAS, discussed below.

WAEMU (UEMOA)⁴
Created by a Treaty signed in Dakar, Senegal, in 1994, the West African Economic and Monetary Union (WAEMU) an organization of eight states⁵ of West Africa established to promote economic integration among countries that share a common currency, the CFA franc. WAEMU is a customs and monetary union between eight members of ECOWAS, which aims to create a common market and customs union, and coordinate macroeconomic, sector, and fiscal policies in order to achieve greater economic competitiveness.

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¹ This appendix is derived primarily from Booz Allen Hamilton (2010), Appendix B. See also N’Guessan (2003a) for more detail.
² Communauté économique des États de l'Afrique de l'Ouest (CEDEAO)
⁴ Union économique et monétaire ouest-africaine
⁵ Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo
TRADE AND TRANSPORT AGREEMENTS

Two main conventions characterize the road transport and transit policies of Senegal and Mali, within the framework of ECOWAS and WAEMU. These in turn have been supplemented over the years by scores of protocols and recommendations, mainly due to the slow progress made implementing these conventions among ECOWAS and WAEMU member states. In addition, a framework of bilateral agreements exists between Senegal and Mali.

Inter-State Road Transport Convention

The Convention A/P.2/5/82 regulating Inter-State Road Transport (TIE) was adopted by ECOWAS and WAEMU, with the objective of establishing the conditions for inter-State road transport within ECOWAS. Specifically, the convention aims to:

- Eliminate excessive road checks;
- Ensure equitable access to the freight generated by the external trade of the contracting parties and harmonize the regulations concerning the highway code and transport;
- Establish sufficient autonomy to ensure supplies to landlocked countries, in keeping with the transportation means of the transit countries.

To this end, the TIE Convention provides for the setting of annual quotas, by countries, of vehicles authorized to undertake inter-State transport; the setting of rules on the distribution of freight between transit states and landlocked countries, in respect of goods in transit and those placed on local markets in the transit countries; the setting of itineraries open to inter-State traffic; and the setting of axle loads.

WAEMU Axle Load Limit Regulation

Signed under the auspices of WAEMU in 2005, and in line with the provisions of the ECOWAS IST convention, the Regulation No. 14/2005/CM/UEMOA regarding Axle Load Limits sets up Axle Load Limit Policies and outline permissible load limits for different types of trucks.

Enforcing axle load limits has posed a particular challenge in the region, with ECOWAS states only recently beginning to implement the requirements embodied in the convention and complying with the WAEMU regulation. Overloading trucks has been a wide-spread practice throughout the region, and many trucks have been heavily reinforced in order to carry excessive loads – a practice that significantly increases the tare weight of the trucks and therefore severely limits the weight of cargo that can be legally carried for the operators to meet the gross axle-weight limits.

As of June 2010, all WAEMU countries had agreed to and were expected to begin enforcing axle-weight limits; however, at the time of writing, neither Senegal nor Mali had yet done so. Senegal has experienced delays with the installation of weighbridges, and Mali is faced with enforcing the rules on a newly-upgraded fleet that is much heavier than the regulations’ allowance. Nevertheless, Mali has installed 5 weighbridges, at border crossings with Senegal (at Diboli), Côte d’Ivoire, Burkina Faso, Ghana, and Burkina Faso via Togo, which together handle 90

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6 Transport Routier Inter-États (TIE)
percent of the traffic coming into Mali. Senegal, on the other hand, is going through a tender process for the selection of an entity to install and operate its weighbridge facilities along the corridor (expected to be co-located at joint control post facilities). It is expected that CCIAD will operate its existing weighbridge at the Port of Dakar for WAEMU regulation enforcement purposes. Both countries are expected to begin enforcement by the end of 2010.

**Convention on Interstate Transit of Goods by Road**

This agreement, the Convention A/P4/5/82 concerning inter-state transit of goods by road (TRIE) comprises economic or customs arrangements which allow goods to be transported by road, with all duties, taxes and restrictions suspended by the customs service of a given member state, to the customs agency of another member state, under cover of a single document (the State Road Transit Declaration, or Le Carnet TRIE), without any unloading. The TRIE declaration serves to:

- Approve the technical characteristics of means of transport;
- Identify the goods, the vehicle and the purpose of the transit;
- Trace the itinerary and offices visited, including frontiers and destination;
- Specify journey deadlines and other requirements with which the driver must comply;
- Determine the scope of application of the transit arrangements and declaration (national territory, several frontiers);
- Determine the liability of the principal responsible (carrier/forwarding agent);
- Set the procedures applicable to cases of force majeure;
- Provide statistical support and information for use in dealing with offences, settling disputes and effecting cooperation between customs services.

However, ratification and actual implementation proved problematic, and an additional convention A/SP.1/5/90 was adopted, which defined a chain of national bodies responsible for the guarantee, with each national body designated by each member state. The supplementary convention also specifies that the guarantee should cover at least the sum of duties and taxes payable on the goods and any penalties that might be incurred. In ECOWAS Member Countries, members’ respective Chambers of Commerce assume the role of the national body.

In practice, the ECOWAS-wide TRIE initiative’s success has been limited, due in part to the absence of a common regional guarantee system. About 70 percent of the transit procedures in the ECOWAS region still stem from bilateral accords and national regulations and practices. This situation is summarized in Table C-1.

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7 Convention relative au Transit Routier Inter-Etats des marchandises (TRIE); not to be confused with TIE – Transport Routier Inter-Etats
8 In Senegal – Chambre de Commerce d’Industrie et d’Agriculture de Dakar (CCIAD); in Mali – Chambre de Commerce et d’Industrie du Mali (CCIM)
The results of these arrangements are illustrated by the agreements between Senegal and Mali. In 2002 these countries signed a bilateral agreement regarding the transit of goods by road, following the ECOWAS TRIE principles. The agreement stipulates that:

1. Throughout the TRIE transport, duties and taxes due on the goods are suspended and secured by guarantee, which is to be paid at departure, and is to be in the amount of 0.5 percent of the CIF\(^\text{10}\) value of the goods (of which 0.25 percent is due to each Senegal and Mali, with the GoS collecting the entire amount, and reimbursing the GoM);

2. Goods movement in approved vehicles or containers under customs seal, therefore eliminating the need for Customs escorts;

3. The State Road Transit Declaration or TRIE carnet is the single customs declaration for transport of goods, is taken into use in the country of departure, and enables Customs control in the country of departure, transit and destination

4. Except at the Customs office of departure and the Customs office of destination, there would be no controls during transit

In reality, none of these items are functioning as intended and the agreement was effectively not implemented as of the end of 2010.\(^\text{11}\)

**ECOWAS Brown Card\(^\text{12}\)**

The Protocol A/P.1/5/82 establishing the ECOWAS Brown Card on transport insurance establishes the ECOWAS Carte Brune for the purposes of third-party civil liability motoring insurance. The carrier must take out third-party insurance to cover accidents caused by vehicles in member states. The Carte Brune functions on the basis of a joint guarantee provided by the authorized insurance companies. Both Senegal and Mali adhere to the Carte Brune agreement.

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\(^{10}\) Cost, Insurance, and Freight is an internationally accepted INCOTERM.

\(^{11}\) Booz Allen Hamilton (2010) Appendix B.

\(^{12}\) Carte Brune in French.
**Table B-1**

*Bilateral and Multilateral Agreements Among UEMOA Countries on Transit*

<table>
<thead>
<tr>
<th></th>
<th>Benin</th>
<th>Burkina</th>
<th>Côte d'Ivoire</th>
<th>Guinée Bissau</th>
<th>Mali</th>
<th>Niger</th>
<th>Togo</th>
<th>Sénégal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>AR AP AT AM</td>
<td>AR AP AT AM</td>
<td>AT</td>
<td>AR AP AT AM</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td>AR AT</td>
<td></td>
</tr>
<tr>
<td>Burkina</td>
<td>AR AP AT AM</td>
<td>AR AP AT AM AF</td>
<td>AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td></td>
</tr>
<tr>
<td>Côte d'Ivoire</td>
<td>AR AP AT AM</td>
<td>AR AP AT AM AF</td>
<td>AT</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td></td>
</tr>
<tr>
<td>Guinée Bissau</td>
<td>AT</td>
<td>AT</td>
<td>AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
</tr>
<tr>
<td>Mali</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AP AT AF</td>
<td>AR AP AT AF</td>
<td></td>
</tr>
<tr>
<td>Niger</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td></td>
</tr>
<tr>
<td>Togo</td>
<td>AR AT</td>
<td>AR AP AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AP AT</td>
<td>AR AP AT AM</td>
<td>AR AT</td>
<td></td>
</tr>
<tr>
<td>Sénégal</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AT</td>
<td>AR AP AT AF</td>
<td>AR AT</td>
<td>AR AT</td>
<td></td>
</tr>
</tbody>
</table>

*AR: Accord Routier; AF: Accord Ferroviaire; AP: Accord Portuaire; AM: Accord Maritime; AT: Accord de Transit*

*Source: N’Guessan (2003a)*
ECOWAS/WAEMU Regional Trade Facilitation Programme

The Regional Facilitation Programme was formally adopted by the Councils of Ministers of ECOWAS and UEMOA in 2003. A Transport Facilitation Unit, hosted by the ECOWAS Commission, is tasked with the implementation of the Regional Facilitation Programme. The program was established to:

- Remove physical and non-physical barriers to ensure better flow of traffic and facilitation of trade
- Improve the maintenance of priority regional infrastructure
- Harmonize technical standards and safety regulations
- Create regional physical facilitation infrastructures.

Border crossings contribute to transit delays because of duplication of procedures, paperwork, and the different operating hours. In recognition of the opportunity to improve efficiencies at the border, and also building on the recommendations of WCO SAFE Framework, ECOWAS and WAEMU are taking the lead for the establishment of joint border posts. Resolution 08/2001/CM provides funding for the construction of 11 joint border posts, including a Kidira/Diboli joint border post. Implementation has been slow, however, and for the moment a joint Kidira/Diboli border post remains in the early planning stages. Similarly, ECOWAS and WAEMU are also pursuing the integration of customs automated systems within member countries with the use of a single, uniform customs clearance document.

ROAD TRANSPORT CHECKPOINTS

Improved Road Transport Governance

The Improved Road Transport Governance (IRTG) initiative began in 2005 as a joint effort of UEMOA and ECOWAS, financed by USAID and the World Bank’s sub-Saharan Africa Transport Policy Program (SSATP) with the West Africa Trade Hub as its implementing partner. The IRTG monitors trends in road harassment on the Tema-Ouagadougou, Ouagadougou-Bamako, Lomé-Ouagadougou and Bamako-Dakar corridors with the aim of eliminating the barriers, delays and bribes which affect drivers along major interstate trade routes in West Africa. Interviews are conducted with truckers and the experiences of Trade Hub transport evaluators who work in the field. The findings are mapped and reveal the best and worst checkpoints on the five corridors monitored by the Trade Hub and UEMOA.

Reduction of Checkpoints

With a view to limit road checks for transit trucks, UEMOA adopted Directive 08/2005/CM/UEMOA on December 16th 2005. Containers, reefer trucks, tanker trucks, and all compliant trucks (according to the Inter-State Road Transit Convention) are to be controlled only at departure, arrival, and at border crossings; other controls are forbidden. In practice, this directive has not been implemented, and checkpoints proliferate along West Africa’s main

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1 Arrete Primatorial Portant reduction des points de controle sur les axes routiers inter-Etats reliant le Senegal et les Etats voisins membres de l’Union Economique Monetaire Ouest Africaine (UEMOA).
transport arteries. As measured and reported in quarterly IRTG reports, in some instances checkpoints along the corridors are increasing.

**BILATERAL AGREEMENTS**

**Example of a Bilateral Agreement: Memorandum of Agreement on Road Transport between Senegal and Mali**

This bilateral agreement between the Governments of Senegal and Mali intends to harmonize the countries’ respective policies in the area of road transport. It sets rules governing the road transport of passengers and cargo between the territories of Senegal and Mali, including:

- Total vehicle weight and dimension limits
- Inter-state insurance (Brown Card) requirements
- Road controls
- Definition of the inter-state corridor
- Freight sharing arrangement
- Authorization to transport
- Technical visit requirements
- Documentation requirements

The freight sharing arrangement sets the distribution of total freight tonnage passing through the Port of Dakar and destined to Mali such that 2/3 of the total freight tonnage is to be reserved for Malian vehicles and 1/3 is to be reserved for Senegalese vehicles.

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2 Protocole Accord Relatif Aux Transports Routiers Entre Senegal et Mali.
Appendix C. Zambian Trucking Fleet and Trucks in Zambia and South Africa

ZAMBIA TRUCKING FLEET TYPOLOGY

1. *Small trucks*, two axles, used for local distribution and deliveries (less than 3.5 tons) and which do not require an operating permit. These trucks are operated mainly by businesses rather than by transport companies.

2. *Medium sized rigid trucks*, two axles, and smaller articulated trucks with up to four axles (from 3.5 tons to 20 tons). Many of these trucks are also owned and operated by businesses (construction companies, manufacturing companies, wholesalers and retailers) and used mainly for distribution and deliveries, but they also serve the agricultural sector, carrying tobacco, sugar to processing plants and warehouses. These trucks are generally not used for cross-border regional transportation because of the higher cost of operating per ton of freight carried. This category of companies would be the most affected if the rule on cabotage is lifted because this would allow foreign trucking companies to carry out local direct deliveries on a discounted price or tariff basis while waiting for back hauls.

3. *Large Articulated Trucks*, five to eight axles (up to 56 tons) operated by small and medium sized Zambian trucking companies, carrying mainly bulk goods within Zambia (copper metal, copper concentrate, cement, coal, sugar, grain and smaller numbers of containerized goods). This forms the core of the Zambian trucking sector, driven by the current 2006 high demand for transport services from the mining and agricultural sectors. There are many Zambian trucking companies which operate in this category, transporting bulk goods to and from inland ports such as Ndola, Lusaka, Livingstone, Kapiri, transshipped to or from rail, as part of a multi-modal transport system. The demand for road haulage within Zambia is set to increase with the planned increased copper production.

4. *Large Articulated Trucks*, six to eight axles (48 tons to 56 tons), operated by the large Zambian trucking companies on regional routes and cross-border freight services. This is mainly confined to the large operators generally owning between 15 and more than 200 trucks.

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1 From Raballand et al. (2008), page 10.
SOUTH AFRICAN TRUCK FLEET

The Gauteng – Durban freight corridor study, (TMT March 2005), indicated that there were 81,000 registered heavy goods vehicles in Gauteng, (representing 38 percent of the vehicles in South Africa), of which an estimated 50,000 were rigid trucks, 20,000 were articulated combinations, and 10,000 were longer 48t to 56t combinations of the type used for regional freight transport and of the type operated by the Zambian trucking companies. Gauteng represents 38 percent of South Africa’s vehicles, but more likely about 50 percent of the registered heavy trucks in South Africa.

Table C-1

<table>
<thead>
<tr>
<th>Road Route / Corridor</th>
<th>Zambia</th>
<th>South Africa</th>
<th>Other Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zambia – Zimbabwe – South Africa, via Chirundu</td>
<td>500</td>
<td>900</td>
<td>300</td>
</tr>
<tr>
<td>Zambia – Zimbabwe – via Chirundu</td>
<td>100</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>Zambia – Botswana – South Africa, Via Kazungula</td>
<td>200</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Zambia – Tanzania, via Nakonde</td>
<td>100</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>Zambia – DRC via Kasumbulesa (Zambian trucks and trucks in transit)</td>
<td>300</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Zambia – Namibia, via Katimo Mulilo</td>
<td>50</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Zambia – Malawi via Chipata</td>
<td>50</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Zambia internally – Bulk Goods</td>
<td>200</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total number of currently licensed Zambian Heavy Trucks</td>
<td></td>
<td></td>
<td>1,300 – 1,500</td>
</tr>
<tr>
<td>Estimated total number of foreign Heavy Trucks on Zambian routes at any one time</td>
<td></td>
<td></td>
<td>1,200</td>
</tr>
</tbody>
</table>

SOURCE: Raballand et al. (2008), page 14.
Appendix D. Model Data Inputs and Assumptions

This appendix documents the methods and assumptions used to operationalize the variables in the preliminary impact model. The following categories of data and assumptions are covered:

- Data and assumptions concerning West African trucking
- Data on Southern African trucking
- Data and assumptions concerning West African transport pricing
- Assumptions and data on future trade and transit demand for landlocked countries
- Assumptions and data on price elasticities of import and export demand and supply
- Assumptions and data on axle loading and its effects on roads
- Assumptions about the impacts of reforms

The mathematical definitions of relationships for the preliminary model are provided at the end of this appendix.

BASE DATA AND ASSUMPTIONS IN PRELIMINARY MODEL

Data and Assumptions Concerning West African Trucking

Tables D-1 through D-13 summarize data and assumptions for West Africa used in the preliminary impact model for the following categories:

- Transit fleet and fleet shares
- Share of demand carried by type of operator
- Annual kilometers for trucks
- Current truck overloading practices
- Truck operating costs
- Informal payments and delays at borders and checkpoints
- Formal payments made for quota transfers
- Current levels of enforcement of quotas and queuing for transit traffic

Some discussion is provided concerning the sources for certain categories of data.
### Table D-1
*Estimated Landlocked and Coastal Shares of Transit Trucking in Selected West African Corridors in 2015 without reform*

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Landlocked Fleet Share (%)</th>
<th>Coastal Fleet Share (%)</th>
<th>Estimated Transit Fleet 2009</th>
<th>Estimated Transit Fleet 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>80</td>
<td>20</td>
<td>1,800</td>
<td>2,200</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>90</td>
<td>10</td>
<td>3,000</td>
<td>3,600</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>80</td>
<td>20</td>
<td>2,300</td>
<td>2,800</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>10</td>
<td>90</td>
<td>2,300</td>
<td>2,800</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>70</td>
<td>30</td>
<td>800</td>
<td>1,000</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>50</td>
<td>50</td>
<td>2,200</td>
<td>2,600</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>10</td>
<td>90</td>
<td>900</td>
<td>1,100</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>30</td>
<td>70</td>
<td>900</td>
<td>1,100</td>
</tr>
<tr>
<td>Lome-Ouagadougou</td>
<td>40</td>
<td>60</td>
<td>2,000</td>
<td>2,400</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>36</td>
<td>64</td>
<td>2,500</td>
<td>3,000</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>70</td>
<td>30</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>45</td>
<td>55</td>
<td>3,000</td>
<td>3,600</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>57</strong></td>
<td><strong>43</strong></td>
<td><strong>22,100</strong></td>
<td><strong>26,700</strong></td>
</tr>
</tbody>
</table>

*NOTE: Total landlocked and coast fleet shares are weighted averages.*

*SOURCE: Booz Allen Hamilton (2010), Ballereau and Douabi (2010), Zerelli and Cook (2010) and surveys reported in Nathan Associates Inc. (2011) with interpretations and adjustments for more openness to trade and fewer checkpoints in Côte d’Ivoire.*

### Table D-2
*Estimated Proportion of Transit Demand Carried by Operator Type (%)*

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent Transit Demand Carried by Formal Sector</th>
<th>Percent Transit Demand Carried by Informal Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cote d’Ivoire and Ghana</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>Other West African countries</td>
<td>15 (updated by the 2011 survey results)</td>
<td>85</td>
</tr>
</tbody>
</table>

*SOURCE: Estimates based on Zerelli and Cook (2010).*

### Table D-3
*Annual Km by Age of Trucks in West Africa*

<table>
<thead>
<tr>
<th>Age of Truck</th>
<th>Average Annual km</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>52,000</td>
<td>1.00</td>
</tr>
<tr>
<td>6-10 years</td>
<td>45,000</td>
<td>0.87</td>
</tr>
<tr>
<td>11-16 years</td>
<td>40,000</td>
<td>0.77</td>
</tr>
<tr>
<td>17-20 years</td>
<td>30,000</td>
<td>0.58</td>
</tr>
</tbody>
</table>

*SOURCE: Based on Terevaninthorn and Raballand (2008).*
### Table D-4
Assumed Annual Km and Age of Trucks for Different Countries in West Africa

<table>
<thead>
<tr>
<th>Age of Truck</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Côte d’Ivoire</th>
<th>Ghana</th>
<th>Mali</th>
<th>Niger</th>
<th>Senegal</th>
<th>Togo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>90,000</td>
<td>52,000</td>
<td>100,000</td>
<td>52,000</td>
<td>52,000</td>
<td>45,000</td>
<td>52,000</td>
<td>60,000</td>
</tr>
<tr>
<td>6-10 years</td>
<td>78,000</td>
<td>45,000</td>
<td>87,000</td>
<td>45,000</td>
<td>45,000</td>
<td>39,000</td>
<td>45,000</td>
<td>52,000</td>
</tr>
<tr>
<td>11-16 years</td>
<td>69,000</td>
<td>40,000</td>
<td>77,000</td>
<td>40,000</td>
<td>40,000</td>
<td>35,000</td>
<td>40,000</td>
<td>46,000</td>
</tr>
<tr>
<td>17-20 years</td>
<td>52,000</td>
<td>30,000</td>
<td>58,000</td>
<td>30,000</td>
<td>30,000</td>
<td>26,000</td>
<td>30,000</td>
<td>35,000</td>
</tr>
</tbody>
</table>

SOURCE: Table D-3, Table 5 and consultant’s estimates.

### Truck Overloading

The current status of truck overloading is very incomplete, but the following table summarizes assumptions used in the preliminary model, based on recent data for Ghana (Vision Consult Limited 2011), Benin and Niger and older data from Senegal (Nordengen et al. 2006) and other countries noted in Zerelli and Cook (2010).

### Table D-5
Estimated Average Percent Truck Overloading in West Africa

<table>
<thead>
<tr>
<th>Country and Operator Type</th>
<th>Percent Overloading</th>
<th>Average Overload for Overloaded Trucks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal sector</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>Informal sector</td>
<td>40</td>
<td>28</td>
</tr>
</tbody>
</table>


These overloading statistics apply to traffic in both directions. However, for transit traffic the overloading takes place primarily in the import direction for landlocked countries. Therefore in the preliminary model we have estimated a factor of 1.8 for overloading of transit trucks in the import direction, which is based on the assumption that 90% of overloading takes place for import traffic.

Fleet composition needs more research in West Africa, but the following estimates have been created based on an extension of the 2011 survey results for Benin and Niger.
### Table D-6

*Estimated Fleet Composition for Heavy Goods Vehicles in West Africa*

<table>
<thead>
<tr>
<th>Fleet</th>
<th>Truck Size</th>
<th>Percent of Heavy Goods Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit formal sector</td>
<td>Medium (25-30t)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Large (35-40t)</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Very large (45-51t)</td>
<td>74</td>
</tr>
<tr>
<td>Transit informal sector</td>
<td>Medium (25-30t)</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Large (35-40t)</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Very large (45-51t)</td>
<td>0</td>
</tr>
<tr>
<td>Domestic</td>
<td>Medium (25-30t)</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Large (35-40t)</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Very large (45-51t)</td>
<td>0</td>
</tr>
</tbody>
</table>

*Source: Estimates based on 2011 survey in Benin and Niger.*

### Truck Operating Costs

Various sources for vehicle operating costs for formal and informal sector operators in West Africa are summarized in Table D-7. In the preliminary model we used these data to estimate standard base fixed and variable operating costs per truck type and operator type (formal and informal) with and without overloading, after informal payments were separated out from vehicle operating costs (see Table D-8). Although truck operating costs vary from country to country, we use standard base cost function so cost variations due to policy changes can be modeled without minor country differences unrelated to reform do affecting the analysis.

These base costs assume that formal sector operators purchase new vehicles and do not keep them longer than 15 years. Informal operators are assumed to purchase used vehicles and to keep them 25-30 years, with higher levels of repairs and down times, but lower depreciation costs.

Informal payments or bribes that are related to reforms are treated as a separate cost item. The level of these payments in current operating costs for formal sector operators is presented in Tables D-10 to D-13. They are specified as (1) informal payments/bribes paid by drivers at checkpoints and border posts and (2) payments for the transport of goods under quotas that are allocated to other countries. Informal sector operators are assumed to pay lower amounts of informal payments per year due to lower annual km, which means fewer trips per year.1

---

1 It is reported that informal operators may be more prone to pay bribes and have more overloaded vehicles. However, that is not well documented and therefore not modeled here.
### Table D-7

**Vehicle Operating Costs for Trucks in West Africa**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FORMAL SECTOR OPERATORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck legal capacity</td>
<td>30.5 tons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40 tons</td>
</tr>
<tr>
<td>Annual km</td>
<td>45,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100,000</td>
<td>50,000</td>
<td>37,500</td>
</tr>
<tr>
<td>Variable operating costs (US$/truck-km)</td>
<td>0.965</td>
<td>1.495</td>
<td>0.965</td>
<td>0.973</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed operating costs (US$/year)</td>
<td>14,523</td>
<td></td>
<td></td>
<td></td>
<td>53,340</td>
<td>15,500</td>
<td></td>
<td>34,600</td>
</tr>
<tr>
<td>Average unit cost (US$/truck-km)</td>
<td>1.288</td>
<td></td>
<td></td>
<td></td>
<td>2.028</td>
<td>1.309</td>
<td></td>
<td>1.896</td>
</tr>
<tr>
<td>Average cost (US$/ton-km (no overload))</td>
<td>0.042</td>
<td></td>
<td></td>
<td></td>
<td>0.043</td>
<td>0.052</td>
<td></td>
<td>0.048</td>
</tr>
<tr>
<td><strong>INFORMAL SECTOR OPERATORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck legal capacity</td>
<td>30.5 tons</td>
<td>35 tons</td>
<td>35 tons</td>
<td>35 tons</td>
<td></td>
<td>25 tons</td>
<td>40 tons</td>
<td></td>
</tr>
<tr>
<td>Annual km</td>
<td>45,000</td>
<td>90,000</td>
<td>30,000</td>
<td>60,000</td>
<td></td>
<td>21,000</td>
<td>29,000</td>
<td></td>
</tr>
<tr>
<td>Variable operating costs (US$/truck-km)</td>
<td>1.034</td>
<td>0.894</td>
<td>1.025</td>
<td>0.867</td>
<td>1.056</td>
<td>1.118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed operating costs (US$/year)</td>
<td>4,262</td>
<td>9,482</td>
<td>5,224</td>
<td>7,118</td>
<td>2,920</td>
<td>18,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average unit cost (US$/truck-km)</td>
<td>1.129</td>
<td>0.999</td>
<td>1.199</td>
<td>0.986</td>
<td>1.195</td>
<td>1.742</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average cost (US$/ton-km - no overload)</td>
<td>0.037</td>
<td>0.029</td>
<td>0.034</td>
<td>0.028</td>
<td>0.048</td>
<td>0.044</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source**
- Terevaninthorn and Raballand (2008)
- SITRASS (2007)
- Zerelli and Cook (2010)
- Zerelli and Cook (2010)
- Zerelli and Cook (2010)
- Survey for this study, including own-account

**Note:** Variable operating costs include salaries of drivers and related social charges. An exchange rate of 500 FCFA = $1.00 is used.
## Table D-8
Assumed Average Base Operating Costs by Truck Type and Operator Type (excluding informal payments)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Cost Component</th>
<th>Medium Truck (25-30 tons)</th>
<th>Large Truck (35-40 tons)</th>
<th>Very Large Truck (45-51 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without overloaded vehicles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal</td>
<td>Variable costs (US$/truck-km)</td>
<td>$0.95</td>
<td>$1.00</td>
<td>$1.15</td>
</tr>
<tr>
<td></td>
<td>Fixed costs (US$/truck-year)</td>
<td>$15,000</td>
<td>$34,600</td>
<td>$48,000</td>
</tr>
<tr>
<td>Informal</td>
<td>Variable costs (US$/truck-km)</td>
<td>$1.10</td>
<td>$1.15</td>
<td>$1.25</td>
</tr>
<tr>
<td></td>
<td>Fixed costs (US$/truck-year)</td>
<td>$5,500</td>
<td>$12,700</td>
<td>$17,600</td>
</tr>
<tr>
<td><strong>With 30% overloaded vehicles (current conditions)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal</td>
<td>Variable costs (US$/truck-km)</td>
<td>$1.05</td>
<td>$1.10</td>
<td>$1.25</td>
</tr>
<tr>
<td></td>
<td>Fixed costs (US$/truck-year)</td>
<td>$15,000</td>
<td>$34,600</td>
<td>$48,000</td>
</tr>
<tr>
<td>Informal</td>
<td>Variable costs (US$/truck-km)</td>
<td>$1.20</td>
<td>$1.25</td>
<td>$1.40</td>
</tr>
<tr>
<td></td>
<td>Fixed costs (US$/truck-year)</td>
<td>$5,500</td>
<td>$12,700</td>
<td>$17,600</td>
</tr>
</tbody>
</table>

**NOTE:** “Without Overloaded Vehicles”: Overloading increases variable operating costs by 23 percent for overloaded trucks and causes 3 percent increase in the variable costs of all vehicles due to its effects on road conditions (See discussion on axle loading assumptions and data, below).

**SOURCE:** Estimates based on Table D-6, smoothing out country differences and reducing the total by average percentage of informal payments that was included in the base data and adjusting fuel costs from earlier years to account for rising fuel costs and fuel differences between origin country and regional average.

## Trucking Employment
In the analysis of vehicle operating costs in HDM4 formats there is some indication of direct and indirect employment associated with trucking. The direct employment is for drivers, maintenance personnel, and management. The data from Zerelli and Cook (2010) and Terevaninthorn and Raballand (2008) show that there is typically one driver per vehicle, with rare use of driver’s aides. The ratio of labor hours in these data shows approximately 0.7 labor hours of maintenance and repairs per hour of driver time for formal sector operators and 1.8 labor hours of maintenance and repairs per hour of driver time for formal sector operators. To this we need to add management time, which can be estimated at 10 percent of driver time. This results in the following estimates of direct and indirect employment (repairs only). For the purpose of the preliminary model we separate out the part of repairs that would be contracted out by the operators (40 percent of total maintenance and repair time) and call this indirect employment. To estimate total indirect employment, the indirect repair employment would have to be increased to reflect the impacts of expenditures of drivers and management on other sectors. Indications from other sources (e.g., Tirasirichai et al. 2007) show that the impact multiplier for increased transport costs on GDP can be 2 or more, however, a multiplier of 1.5 is a more conservative estimate. If
we assume that a multiplier of 1.5 applies true for employment, and we add to this the repair component, we calculate the figures in Table D-9.

**Table D-9**  
*Estimated Direct Employment and Indirect Employment for West African Truckers by Type of Operator*

<table>
<thead>
<tr>
<th>Category</th>
<th>Formal Sector</th>
<th>Informal Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct employment (drivers, maintenance and management)</td>
<td>1.5 employees/truck</td>
<td>2.2 employees/truck</td>
</tr>
<tr>
<td>Truck repair employment</td>
<td>0.3 employees/truck</td>
<td>0.7 employees/truck</td>
</tr>
<tr>
<td>Indirect employment multiplier (repairs plus other)</td>
<td>1.7 employees/direct employee</td>
<td>1.7 employees/direct employee</td>
</tr>
</tbody>
</table>

*Source: Analysis of operating costs in HDM4 format for West Africa from Teravaninthorn and Raballand (2008-special communication) and Zerelli and Cook (2010).*

**Payments by Truckers for Quota Transfer and Checkpoints in West Africa**  
The following two tables summarize the available data on extra costs paid by truckers in addition to their operating costs for transport on West African corridors.

**Table D-10**  
*Extra Cost Paid to Landlocked Truckers for Loading Quota Shipments on Coastal Trucks in West African Transit Corridors in 2010*

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Cost Paid to Carry Quota Freight by Coastal Truckers (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>110–176</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>110–176</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>220 or more</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Lome-Ouagadougou</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>100–200&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>220–549</td>
</tr>
</tbody>
</table>

<sup>a</sup> Assumed payment where no data exist

### Table D-11
Estimated Amount and Percentage of Quota Payment for Trucks in Transit Trade in 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>Quota Payments Amount Received</th>
<th>Percent of Landlocked Country Transport Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>$7.6 mil</td>
<td>8</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ghana</td>
<td>$0.8 mil</td>
<td>1</td>
</tr>
<tr>
<td>Senegal</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Togo</td>
<td>$2.3 mil</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>$10.7 mil</td>
<td>11</td>
</tr>
</tbody>
</table>

SOURCE: Payments for an estimated 50 percent of Niger imports which cannot be carried by Nigerien truckers.

### Table D-12
Estimates of Average Informal Payments at Checkpoints in West African Transit Corridors in 2011

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Informal Payments per Trip (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>82</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>209</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>182</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>215</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>101</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>28</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>61</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>99</td>
</tr>
<tr>
<td>Lome-Ouagadougou</td>
<td>40</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>54</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>53</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>42</td>
</tr>
</tbody>
</table>


### Table D-13
Estimated Amount and Percentage of Informal Payments/Bribes by Formal Sector for Trucks in Transit Trade in 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>Truck Type</th>
<th>Informal Payments Amount (US$/truck-year)</th>
<th>Percent of Base Operating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>Medium</td>
<td>3,210</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>3,210</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Very Large</td>
<td>3,210</td>
<td>2.1</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>Medium</td>
<td>3,120</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>3,120</td>
<td>4.2</td>
</tr>
</tbody>
</table>
### Data Inputs and Assumptions

#### Informal Payments

<table>
<thead>
<tr>
<th>Country</th>
<th>Truck Type</th>
<th>Amount (US$/truck-year)</th>
<th>Percent of Base Operating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very large</td>
<td></td>
<td>3,120</td>
<td>3.1</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>Medium</td>
<td>14,340 $^a$</td>
<td>14.6</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>14,340 $^a$</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>14,340 $^a$</td>
<td>8.5</td>
</tr>
<tr>
<td>Ghana</td>
<td>Medium</td>
<td>1,990</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>1,990</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>1,990</td>
<td>1.9</td>
</tr>
<tr>
<td>Mali</td>
<td>Medium</td>
<td>3,550</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>3,550</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>3,550</td>
<td>3.4</td>
</tr>
<tr>
<td>Niger</td>
<td>Medium</td>
<td>1,850</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>1,850</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>1,850</td>
<td>1.8</td>
</tr>
<tr>
<td>Senegal</td>
<td>Medium</td>
<td>3,500</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>3,500</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>3,500</td>
<td>3.4</td>
</tr>
<tr>
<td>Togo</td>
<td>Medium</td>
<td>2,400</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>2,400</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Very large</td>
<td>2,400</td>
<td>2.1</td>
</tr>
</tbody>
</table>

$^a$ Half of this amount is assumed to be in place without the reforms in 2015 as part of the preliminary model, since this reduction has already been implemented after the civil unrest was over.

**Source:** IRTG reports for March 2011 multiplied by the average number of trips per year and allocated to national fleets according to the transit corridors served.

#### Average Delays at Borders and Checkpoints by Corridor

**Table D-14**

Estimates of Average Border and Checkpoint Delays in West African Transit Corridors in 2011

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Border Delays per trip (days)</th>
<th>Checkpoint Delays per trip (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>1.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>1.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>1.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>2.2</td>
<td>7.4</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>2.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>1.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>2.3</td>
<td>4.9</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>2.2</td>
<td>6.5</td>
</tr>
</tbody>
</table>
Corridor Border Delays per trip (days) Checkpoint Delays per trip (hours)

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Border Delays</th>
<th>Checkpoint Delays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lome-Ouagadougou</td>
<td>1.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>2.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>1.4</td>
<td>3.6</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>1.4</td>
<td>3.0</td>
</tr>
</tbody>
</table>


**Current Enforcement of Quotas and Queuing Regulations in West Africa**

The situation on enforcement of quotas and queuing is somewhat uncertain as described in Chapter 2, and more data is needed in this area. Table D-15 summarizes the assumptions used in the preliminary model about the enforcement of quotas and queuing in West Africa, based on Zerelli and Cook (2010) and the 2011 survey work in Benin and Niger for this project.

**Table D-15**

*Estimates of Enforcement of Regulations on Loading in West African Transit Corridors in 2011*

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Percent Quotas Enforced</th>
<th>Percent Queuing Enforced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Abidjan-Bamako</td>
<td>20 a</td>
<td>30</td>
</tr>
<tr>
<td>Abidjan-Ouagadougou</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Abidjan-Niamey</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Tema-Bamako</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Tema-Ouagadougou</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Tema-Niamey</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Lome-Bamako</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Lome-Ouagadougou</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Lome-Niamey</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Cotonou-Ouagadougou</td>
<td>80</td>
<td>0 b</td>
</tr>
<tr>
<td>Cotonou-Niamey</td>
<td>80</td>
<td>0 b</td>
</tr>
</tbody>
</table>

*a only for informal sector truckers.

b long delay times (2-3 weeks) experienced by Nigerien operators at the port of Cotonou.


**Data on Southern African Trucking**

The key data on Southern African trucking used in the model as benchmarks are:

- Target of 110,000 annual km for truckers serving the Zambia transit trade
- High proportion of formal sector trucking operators in transit trade
- Low prices per ton-km, related to balanced trade conditions on the North-South corridor, with higher prices for other, less balanced corridors.
Data on West African Transport Pricing

Data on West African transport pricing from published sources is mostly available for transit traffic for past years with comments on recent increases as axle load controls are implemented (see Table D-16), but not for domestic traffic. Nevertheless, the preliminary model can be used to estimate domestic rates, with assumptions about the load factors and profitability of domestic transport. For purposes of the preliminary model the following assumptions were made:

- Profitability of 15-25 percent for domestic trucking
- Load factors of 50 percent for domestic trucking.

This resulted in estimates of current domestic pricing given in Table D-17.

For calculations in the preliminary model an average 10 percent discount on the price in the import direction is assumed for the backhaul direction. Cabotage pricing is assumed to be at 90 percent of domestic rates.

Table D-16
Estimates of Average Transit Prices in the Import Direction for West African Countries in 2010-2011

<table>
<thead>
<tr>
<th>Countries</th>
<th>Average Transit Price (US$/ton-km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin, Togo and Niger</td>
<td>0.095-0.105</td>
</tr>
<tr>
<td>Other West African countries</td>
<td>0.10</td>
</tr>
</tbody>
</table>

*SOURCE: Consultant’s estimates based on data from Ballereau and Douabi (2010), Booz Allen Hamilton (2010), Zerelli and Cook (2010) updated from 2011 survey data for corridors starting in Cotonou and increased to reflect the impact of increased fuel prices by 2011 and axle load controls.*

Table D-17
Estimates of Average Domestic Transport Prices for West African Countries in 2010-2011

<table>
<thead>
<tr>
<th>Countries</th>
<th>Average Transit Price (US$/ton-km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Côte d’Ivoire</td>
<td>0.095</td>
</tr>
<tr>
<td>Benin</td>
<td>0.100</td>
</tr>
<tr>
<td>Other West African countries</td>
<td>0.11</td>
</tr>
</tbody>
</table>

*NOTE: Based on preliminary model with assumptions of 50 percent load factors and 15-25 percent profitability.*

Assumptions and Data on Future Trade and Transit Demand for Landlocked Countries in West Africa

For purposes of this preliminary impact model transit trade forecasts were made for 2015 for Mali, Burkina Faso and Niger. These were derived from the data in SOFRECO and NATHAN ASSOCIATES (2011) which analyzed trade data for African countries, as well as studies of the fuel market in Africa, and data from the 2011 field work in Niger, as shown in Table D-18. This demand is grouped into five categories that are expected to have different responses to price changes due to transport cost reductions as a result of reforms. To forecast transit demand for road transport by corridor, total demand was multiplied by factors by corridor and for the road share of transport in corridors where there is rail available. These factors are shown in Table D-19. The mathematical relationships are specified in section D2 below.
Table D-18
Estimated Transit Trade Demand in 2015 (000 tons)

<table>
<thead>
<tr>
<th></th>
<th>Mali</th>
<th>Burkina Faso</th>
<th>Niger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural imports</td>
<td>360</td>
<td>250</td>
<td>360</td>
</tr>
<tr>
<td>Agricultural exports</td>
<td>360</td>
<td>290</td>
<td>50</td>
</tr>
<tr>
<td>Fuel imports</td>
<td>820</td>
<td>650</td>
<td>220</td>
</tr>
<tr>
<td>Mining imports</td>
<td>n/a</td>
<td>n/a</td>
<td>390</td>
</tr>
<tr>
<td>Mineral exports</td>
<td>n/a</td>
<td>n/a</td>
<td>10</td>
</tr>
<tr>
<td>Non-resource-related imports</td>
<td>1,820</td>
<td>2,700</td>
<td>1,410</td>
</tr>
<tr>
<td>Non-resource-related exports</td>
<td>120</td>
<td>210</td>
<td>70</td>
</tr>
<tr>
<td>Total imports</td>
<td>3,000</td>
<td>3,600</td>
<td>2,380</td>
</tr>
<tr>
<td>Total exports</td>
<td>480</td>
<td>500</td>
<td>130</td>
</tr>
</tbody>
</table>

Source: SOFRECO and NATHAN ASSOCIATES (2011), 2009 demand increased by 20 percent with fuel imports estimated from Kojima et al. (2010) updated from the 2011 survey in Niger. Excluding exports from Niger to Nigeria, which include 500,000 tons of cowpeas plus other agricultural products.

Table D-19
Estimated Corridor and Road Shares of Trade Demand in 2015

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Mali Imports</th>
<th>Mali Exports</th>
<th>Burkina Faso Imports</th>
<th>Burkina Faso Exports</th>
<th>Niger Imports</th>
<th>Niger Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>35</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conakry-Bamako</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abidjan-Ouaga-Bamako</td>
<td>45</td>
<td>45</td>
<td>42</td>
<td>62</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Tema-Ouaga-Niamey/Bamako</td>
<td>7</td>
<td>7</td>
<td>26</td>
<td>10</td>
<td>9</td>
<td>46</td>
</tr>
<tr>
<td>Lome-Ouaga-Niamey/Bamako</td>
<td>8</td>
<td>8</td>
<td>27</td>
<td>23</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Cotonou-Ouaga-Niamey/Bamako</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>55</td>
<td>12</td>
</tr>
<tr>
<td>Lagos-Niamey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Road Shares in 2015 (%)

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Mali</th>
<th>Burkina Faso</th>
<th>Niger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar-Bamako</td>
<td>80</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Abidjan-Ouaga-Bamako</td>
<td>80</td>
<td>80</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>80</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>80</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: Road shares do not include multimodal road + rail transport shares

Source: SOFRECO and NATHAN ASSOCIATES (2011) which includes adjustments for more openness to trade and fewer checkpoints in Côte d’Ivoire, adjusted with information from Zerelli and Cook (2010) and from the 2011 survey for Niger.

Assumptions and Data on Prices and Price Elasticities of Demand and Supply for Landlocked County Trade in West Africa

The base data on prices for the same categories of demand used in section D1.3 above are given in Table D-20. These were derived from the same sources as the estimates of demand. The
mathematical relationships using these prices and price elasticities for forecasting in the preliminary model are specified in the last section of this appendix.

Table D-20
Average Price of Transit Goods per ton (US$/ton in 2011)

<table>
<thead>
<tr>
<th></th>
<th>Mali</th>
<th>Burkina Faso</th>
<th>Niger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture imports</td>
<td>750</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Agriculture exports</td>
<td>850</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>Fuel imports</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
</tr>
<tr>
<td>Mining imports*</td>
<td>n/a</td>
<td>n/a</td>
<td>4,000</td>
</tr>
<tr>
<td>Mineral exports*</td>
<td>n/a</td>
<td>n/a</td>
<td>80,000</td>
</tr>
<tr>
<td>Non-resource-related imports</td>
<td>1,250</td>
<td>1,200</td>
<td>1,000</td>
</tr>
<tr>
<td>Non-resource-related exports</td>
<td>1,450</td>
<td>1,400</td>
<td>1,400</td>
</tr>
</tbody>
</table>

Source: SOFRECO and NATHAN ASSOCIATES (2011), adjusted with field data from Niger, with fuel import prices estimated from Kojima et al. (2010).* Note that mining activity in Niger is considered inelastic, i.e., no response to changes in inland transport prices.

Estimates of the percent of transport costs in import prices are presented in Figure D-1.

Figure D-1
Average Percent of Transport Costs in Import Value by Country in West Africa

Source: N’Guessan (2003a)

A number of studies of import price elasticities in African countries are summarized in Jones (2008). Jones’ research in seven African countries suggests that the aggregate elasticity of price for imports is between -1.1 and -1.5. These elasticities are summarized for selected commodity...
groups in Table D-21 for purposes of this model. Estimates for the elasticity of exports with respect to price would be much lower, particularly for those agricultural exports whose prices are fixed in the world commodity markets, but which could attract some more demand as a lower-cost supplier. Shepherd’s results (2006) indicate that a price elasticity of supply on the order of 0.2 would be appropriate. So we are adopting that estimate for this preliminary model for agricultural exports. Nonresource based exports are assumed to have an elasticity of 1.0. Mining imports and mineral exports are related to uranium mines in Niger and are considered to be inelastic (zero elasticity) with respect to the price changes for transport we are using in the model.

<table>
<thead>
<tr>
<th>Commodity Group</th>
<th>Average Elasticity</th>
<th>Range of Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand Elasticities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural imports</td>
<td>-2.1</td>
<td>-1.5 to -2.4</td>
</tr>
<tr>
<td>Petroleum fuel imports</td>
<td>-1.5</td>
<td>-0.7 to -2.5</td>
</tr>
<tr>
<td>Non-resource-related imports</td>
<td>-1.0</td>
<td>-0.6 to -2.2</td>
</tr>
<tr>
<td>Mining imports*</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total imports</td>
<td>-1.3</td>
<td>-1.1 to -1.5</td>
</tr>
<tr>
<td><strong>Supply Elasticities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural exports</td>
<td>0.2</td>
<td>n/a</td>
</tr>
<tr>
<td>Mineral exports*</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Non-resource-related exports</td>
<td>1.0</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: Jones (2008) and Shepherd (2006). Results interpreted by consultant. * Note that mining activity in Niger is considered inelastic, i.e., no response to changes inland transport prices.

Assumptions and Data on Axle Loading and Its Effect on Roads, Maintenance Costs, and Vehicle Operating Costs

Overloading has a big impact on road surfaces. Pinard (2010, 7-8) quantifies the effect of axle loads over road design levels as an exponential function with a power of four or more. As stated by Pinard, overloading accelerates pavement deterioration and causes it to reach its terminal stage early, usually as a result of unacceptable amounts of rutting or roughness. This entails expenditure sooner than necessary and the construction of more substantial pavement, both of which increase costs for road agencies. Accelerated deterioration also leads to higher vehicle operating costs.3

---

1 These elasticities are somewhat lower than could be interpreted from Nathan Associates (2011a) data for Eastern and Southern Africa which focused on the generalized cost component of prices. However, they fall in the mid range of other researchers’ results as reported by Jones (2008).

2 Exports of precious stones are not included in this analysis as they do not affect transport volumes.

3 Other impacts include increased failure rates for bridges and road accidents as overloaded vehicles lose control or tip over. These are not quantified here.
The actual percent of overloaded vehicles varies over the year and has been declining in Ghana for the country as a whole (15 percent in 2009 compared to 25 percent in 2008) as enforcement has increased (Vision Consult Limited 2011). However, it is also reported that most truckers on the Tema-Ouagadougou corridor were carrying 60-70 tons of cargo (i.e., an average of 14 tons overload per vehicle and a range of 9-19 tons). In Senegal, overloading occurred with 16 percent of the heavy goods vehicles in 2006 with an average of 7 tons overload per vehicle according to Nordengen (2006), but in the Dakar-Bamako corridor it is 31 percent.

The effect of overloading is calculated here by assuming an average rate of overloading and a distribution of severity of this overloading. This is linked to the need to replace road surfaces more rapidly as well as needs for more maintenance per year. Analysis of these costs has been carried out for Ghana and Burkina Faso using HDM4 modeling. The results are given in Table D-22. The differences are said to be related to the quality of the road networks in each country as well as to methodological differences.

### Table D-22

<table>
<thead>
<tr>
<th>Country</th>
<th>Cost/km/yr (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>41,379</td>
</tr>
<tr>
<td>Ghana</td>
<td>15,411</td>
</tr>
</tbody>
</table>


For purposes of the preliminary model the assumptions concerning additional road maintenance and repair costs of overloading are

- US$15,000-20,000/km-year for Ivory Coast and Ghana
- US$30,000-45,000/km-year for other countries.

According to a detailed analysis of the Tema-Ouagadougou corridor in 2010, about 10 percent of the corridor has road surface in poor condition, with the rest in fair to good condition (Nathan Associates Inc. 2010, 15). For the purpose of this preliminary model this level of deterioration is taken to be typical of corridors with axle overloading in West Africa. This results in an increased vehicle operating costs (VOCs) for these sections of 15 percent-21 percent for heavy goods vehicles (or about 23 percent of variable costs on average), and an average increase of 2 percent in truck VOCs for the corridor as a whole. This relationship is used to calculate the effects on vehicle operating costs for truckers due to overloading which is assumed to be the impact in the preliminary model.

---

4 Based on an analysis using the HDM4 VOC model and detailed data from Terevaninthorn and Raballand for a West African heavy goods vehicle.

5 This calculation underestimates the effect on all vehicles using the road, but since the percentage of road in bad condition also depends on the efficiency of the road agency, it overstates the link to overloading.
When overloading is eliminated, fuel and tire costs also decline. These declines have been quantified empirically in Ghana by Ghana Cement Company (12.5 percent reduction in fuel costs and 58 percent in tire costs). These savings would not be realized by all truckers, so one-third of these savings was taken as an average for all trucker cost savings, which is in line with assumptions made for Ghanaian trucking impacts on Tema-Ouagadougou and Tema-Niamey corridors. This results in assumptions for overloaded vehicles shifting to legal loads of

- 4 percent reduction on average for truck fuel costs
- 19 percent reduction on average for truck tire costs.

This converts to a combined effect on variable operating costs of 25 percent for overloaded vehicles and 3 percent for other vehicles in current conditions, as shown in Table D-8 above. There is no impact on fixed costs.

### Assumptions and Data on Nontrucking Employment Impact

Some research has been carried out by Bromley (2011) on multipliers for both income and employment derived from analysis of production and supply chains for selected products in West Africa (Table D-23). This is not comprehensive, and the numbers are highly uncertain but can serve as a basis for estimates of these multipliers in the preliminary impact model.

#### Table D-23

*Income and Employment Multipliers for Selected Export-Related Products in West Africa*

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Regional Income Multiplier</th>
<th>Part-time Employment per $1,000 of Sales</th>
<th>Full-time Equivalent Employment per $1,000 of Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cashews</td>
<td>2.43</td>
<td>120</td>
<td>6 - 24</td>
</tr>
<tr>
<td>Baskets</td>
<td>1.58</td>
<td>16</td>
<td>1 - 3</td>
</tr>
<tr>
<td>Wood products and furniture</td>
<td>2.15</td>
<td>54</td>
<td>3 - 10</td>
</tr>
<tr>
<td>Shea Products</td>
<td>1.58</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>1.94</strong></td>
<td><strong>63</strong></td>
<td><strong>3 - 12</strong></td>
</tr>
</tbody>
</table>

*NOTE: Part-time employment per $1,000 of sales includes direct and indirect combined. Full-time equivalent estimated by consultant.*

*SOURCE: Bromley (2011).*

These multipliers relate to sales of the products. For example, a $1,000 increase in sales would increase regional income by $940 on average, and produce an average of 3-12 full time equivalent jobs in the regional economy. The types of jobs cited by Bromley in the detailed analysis of West African supply chains provided by this research are: buyers, workers, managers and supervisors, transporters, warehouse workers, suppliers and agents.

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6 As reported by Vision Consult Limited (2011), pages 53-54.
For purposes of the preliminary model, we use the assumptions in Table D-24 as a placeholder for employment multipliers until better estimates are available. A range is used to indicate uncertainty in the estimates which excludes the transport component (2 percent of jobs created) to avoid double counting. Fuel jobs are considered to have a much lower multiplier than other sectors (excluding transport jobs) due to the lean supply chain structure of that industry (one third as many as the average for other industries according to USBEA, 2002). Imports are assumed to have only 1/10 the impact as for the production of exports. Clearly more research is needed to verify and improve these estimates.

Table D-24

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Estimated Range of Regional Employment Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural imports</td>
<td>0.0003 to 0.0012</td>
</tr>
<tr>
<td>Agricultural exports</td>
<td>0.001 to 0.012</td>
</tr>
<tr>
<td>Fuel imports</td>
<td>0.00001 to 0.00004</td>
</tr>
<tr>
<td>Non-resource-related imports</td>
<td>0.0001 to 0.0004</td>
</tr>
<tr>
<td>Non-resource-related exports</td>
<td>0.001 to 0.004</td>
</tr>
</tbody>
</table>

*Source: Consultant’s estimates.*

**Assumptions About Impact of Trucking Reform in West Africa**

The reforms assumed for the preliminary model analysis include:

- Elimination of quotas and queuing
- Restrictive or quality licensing of vehicles and drivers
- Tax incentives to modernize fleets
- Minimizing of border formalities and road checkpoints.

The elimination of quotas and queuing is expected to eliminate waiting times for trucks, which increases annual km and creates a more competitive environment, which leads to a greater share of formal sector operators and better performing fleets. The combination of quality licensing and incentives will complement the elimination of quotas and queuing by making all formal sector fleets and one-third of informal sector fleets similar to Southern Africa (average age of 6 years).

For purposes of the preliminary model and for the maximum impact scenario it is assumed that:

- As in Southern Africa 80 percent of the transit fleet will be formal sector by 2015.
- There is a spillover of industry structure to the domestic fleet where 20 percent more of the domestic fleet will be formal sector by 2015 in Côte d’Ivoire, Ghana and Senegal, 30 percent more in Burkina Faso, Mali, and Niger and 40 percent more in Benin and Togo.
- Incentives for fleet modernization will provide a discount of 20 percent of cost of new vehicles and interest for the transit fleet. This is a savings to operators and a cost to the government.
- Minimizing border and checkpoint procedures will lead to a maximum of 3 checkpoints for coastal countries and two for landlocked countries.
• Annual km for transit trucks will increase by 20,000 up to a maximum of 110,000 for formal operators due to border and checkpoint delay reductions, and a maximum of another 10,000 for elimination of queuing.\(^8\)

• The age distribution for formal sector truck fleets will be similar to Southern Africa, averaging 6 years of age.

• 60 percent-65 percent of cost changes for transporters will be passed on to shippers as transport price changes.

• Transport price margins over costs for the highest cost country will drop to 15 percent - 20 percent after reforms due to increased competition (lower cost truckers from other countries will have higher margins).

• 70 percent of transport price changes to shippers will be passed on to consumers or producers.

The key assumptions are summarized in Table 24 in Chapter 5 and the results of the impact assumptions on annual km are summarized in Table 26 in Chapter 5.

**MATHEMATICAL RELATIONSHIPS IN THE PRELIMINARY MODEL**

**Transit Demand**

\[
TD_i = \sum_j \left( B_{im} * S_{ijm} * L_j * RS_{ijm} + B_{ix} * S_{ijx} * L_j * RS_{ijx} \right) * T_{ij}
\]

Where:

\(TD_i\) = Demand for freight transit transport in ton-km carried by country \(i\) truckers

\(B_{im}\) = Base demand for country \(i\) imports in tons per year

\(B_{ix}\) = Base demand for country \(i\) exports in tons per year

\(S_{ijm}\) = Share of demand for country \(i\) imports that uses corridor \(j\)

\(S_{ijx}\) = Share of demand for country \(i\) exports that uses corridor \(j\)

\(RS_{ijm}\) = Road share of demand for country \(i\) imports that uses corridor \(j\) (less than 100 percent where there is competing rail transport)

\(RS_{ijx}\) = Road share of demand for country \(i\) exports that uses corridor \(j\) (less than 100 percent where there is competing rail transport)

\(T_{ij}\) = Share of transit traffic for country \(i\) truckers along corridor \(j\)

\(L_j\) = Length of corridor \(j\) in kilometers

---

\(^8\) A fraction of the 10,000 will be added to annual km as a function of the percent that queuing is currently enforced in the associated transport corridors.
**Domestic Trucking Demand**

\[
DD_i = \sum_t (DF_{it} * l_{it} * A_{it} * (1 - DU_{it})) * l_f
\]

Where:
- \(DD_i\) = Demand for domestic freight transport in ton-km for country \(i\)
- \(DF_{it}\) = Number of trucks in the domestic fleet for country \(i\) and operator type \(t\)
- \(l_{it}\) = average load per loaded truck for country \(i\) truckers and operator type \(t\)
- \(A_{it}\) = Average annual km for a truck in the country \(i\) trucking fleet for operator type \(t\)
- \(DU_{it}\) = Percent of trucks in the domestic fleet that are unavailable for country \(i\) and operator type \(t\)
- \(l_f\) = Average load factor for domestic trucking

**Cabotage Demand (If cabotage is allowed in the Scenario for country i truckers)**

\[
CD_i = TD_i * Pl
\]

Where:
- \(CD_i\) = Demand for cabotage transport in ton-km carried by country \(i\) truckers
- \(TD_i\) = Demand for freight transit transport in ton-km for country \(i\)
- \(Pl\) = Assumed percent additional load factor gained by transit truckers due to cabotage haulage

**Average Load for Domestic Trucks**

\[
l_{it} = \sum_v k_v * PF_{itv} * (1 + POV_{it} * PO)
\]

Where:
- \(l_{it}\) = average load per loaded truck for country \(i\) truckers and operator type \(t\)
- \(k_v\) = Legal capacity for truck type \(v\)
- \(PF_{itv}\) = Percent fleet composed of truck type \(v\) for country \(i\) truckers of operator type \(t\)
- \(POV_{it}\) = Percent overloaded trucks in both directions for country \(i\) truckers of operator type \(t\)
- \(PO\) = Average overload as a percent of legal capacity that is carried by an overloaded truck

**Average Load for Transit Trucks in Import Direction**

\[
Il_{it} = \sum_v k_v * PF_{itv} * (1 + POV_{it} * DF * PO)
\]

Where:
- \(Il_{it}\) = average load per loaded transit truck in import direction for country \(i\) truckers and operator type \(t\)
\( k_v \) = Legal capacity for truck type \( v \)
\( PF_{itv} \) = Percent fleet composed of truck type \( v \) for country \( i \) truckers of operator type \( t \)
\( POV_{it} \) = Percent overloaded trucks in both directions for country \( i \) truckers of operator type \( t \)
\( PO \) = Average overload as a percent of legal capacity that is carried by an overloaded truck
\( DF \) = Directional factor to convert average overload in both directions to overload in import direction

**Transit Fleet Size**

\[
TF_{it} = TD_{im} \times 2 \times Pt / (II_{it} \times A_{it} \times (1 - U_{it}))
\]

Where:
- \( TF_{it} \) = Number of trucks in the fleet for country \( i \) and operator type \( t \)
- \( TD_{im} \) = Transit demand for imports by country \( i \) truckers
- \( Pt \) = Assumed percent of transit transport carried by country \( i \) truckers of operator type \( t \)
- \( II_{it} \) = average load in the import direction per loaded truck for country \( i \) truckers and operator type \( t \)
- \( A_{it} \) = Average annual km for a truck in the country \( i \) trucking fleet for operator type \( t \)
- \( U_{it} \) = Percent of trucks in the transit fleet that are unavailable for country \( i \) and operator type \( t \)

**Transit Fleet Empty Return Percent**

\[
M_i = (TD_{im} - TD_{ix} - CD_i) / TD_{im}
\]

Where:
- \( M_i \) = Percent of transit trucks with empty returns for country \( i \)
- \( TD_{im} \) = Transit demand for imports by country \( i \) truckers
- \( TD_{ix} \) = Transit demand for exports by country \( i \) truckers
- \( CD_i \) = Demand for cabotage transport in ton-km for country \( i \) truckers

**Transit Truck Operating Costs**

\[
TC_{it} = TF_{it} \times (1 - TU_{it}) \times \left( \sum_{v} (f_{c_{itv}} \times PV_{itv} + v_{c_{itv}} \times TV_{itv} \times A_{it} \times (1 + PO_{it} \times O_i) \times (1 + PP_i) \times (1 - M_i \times MC_i / 2) \right)
\]

Where:
- \( TC_{it} \) = Total operating costs for transit trucks from country \( i \) and operator type \( t \)
- \( TF_{it} \) = Number of trucks in the transit fleet for country \( i \) and operator type \( t \)
- \( TU_{it} \) = Percent of trucks in the transit fleet that are unavailable for country \( i \) and operator type \( t \)
- \( f_{c_{itv}} \) = Average fixed operating costs per year for country \( i \) truckers with operator type \( t \) and vehicle type \( v \)
DATA INPUTS AND ASSUMPTIONS

\( \text{vc}_{\text{itv}} = \) Average base variable operating costs per ton-km for country i truckers with operator type t and vehicle type v

\( \text{TV}_{\text{itv}} = \) Percent of vehicle type v in the transit fleet for country i and operator type t

\( A_{\text{it}} = \) Average annual km for a truck in the country i trucking fleet for operator type t

\( \text{PO}_{\text{it}} = \) Percent overloaded trucks for country i and operator type t

\( O_i = \) Percent variable cost increase for overloading by country i truckers

\( \text{PP}_i = \) Percent pavement condition effect on variable operating costs for country i truckers due to overloading

\( M_i = \) Percent of transit trucks with empty returns for country i

\( \text{MC}_i = \) Percent decrease in variable operating costs for empty returns with country i truckers

**Domestic Truck Operating Costs**

\[
\text{DC}_{\text{it}} = \text{DF}_{\text{it}} \times (1 - U_{\text{it}}) \times (\sum_v (f_{\text{c}_{\text{itv}}} \times \text{DV}_{\text{itv}} + \text{vc}_{\text{itv}} \times \text{DV}_{\text{itv}} \times A_{\text{it}} \times (1 + \text{PO}_{\text{it}} \times O_i) \times (1 + \text{PP}_i) \times (1 - 0.5 \times \text{MC}_i))
\]

Where:

\( \text{DC}_{\text{it}} = \) Total operating costs for domestic trucks from country i and operator type t

\( \text{DF}_{\text{it}} = \) Number of trucks in the fleet for country i and operator type t

\( U_{\text{it}} = \) Percent of trucks in the transit fleet that are unavailable for country i and operator type t

\( f_{\text{c}_{\text{itv}}} = \) Average fixed operating costs per year for country i truckers with operator type t and vehicle type v

\( \text{vc}_{\text{itv}} = \) Average base variable operating costs per ton-km for country i truckers with operator type t and vehicle type v

\( \text{DV}_{\text{itv}} = \) Percent of vehicle type v in the domestic fleet for country i and operator type t

\( A_{\text{it}} = \) Average annual km for a truck in the country i trucking fleet for operator type t

\( \text{PO}_{\text{it}} = \) Percent overloaded trucks for country i and operator type t

\( O_i = \) Percent variable cost increase for overloading by country i truckers

\( \text{PP}_i = \) Percent pavement condition effect on variable operating costs for country i truckers due to overloading

\( \text{MC}_i = \) Percent decrease in variable operating costs for empty returns with country i truckers

**Transit Revenues**

\[
\text{TR}_i = \text{tr}_i \times T\text{D}_{\text{im}} + 0.9 \times \text{tr}_i \times T\text{D}_{\text{ix}} + 0.9 \times d_{\text{jr}} \times C\text{D}_i
\]

Where:

\( \text{TR}_i = \) Revenue for freight transit transporters from country i

\( \text{tr}_i = \) Transit tariff per ton-km for country i in import direction
TD_{im} = Transit demand for imports carried by country i truckers
TD_{ix} = Transit demand for exports carried by country i truckers
dr_{j} = Domestic tariff per ton-km for country j
CD_{i} = Demand for cabotage transport in ton-km for country i truckers

**Trucking Direct Employment**

\[ E_i = \sum_t TF_{it} * (1 - TU_{it}) * e_{it} + DF_{it} * (1 - DU_{it}) * e_{it} \]

Where:
E_{i} = Total direct employment in the trucking industry for country i
TF_{it} = Number of trucks in the transit fleet for country i and operator type t
TU_{it} = Percent of trucks in the transit fleet that are unavailable for country i and operator type t
DF_{it} = Number of trucks in the fleet for country i and operator type t
U_{it} = Percent of trucks in the transit fleet that are unavailable for country i and operator type t
e_{it} = Direct employment factor per vehicle with operator type t in country i

**Government Subsidies for Truck Purchases (If subsidies are part of reforms)**

\[ S_i = PV * VP * PR * TF_{i} * (1 + (I - SI)) \]

Where:
S_{i} = Government subsidy of the trucking industry for country i
PV = Percent of subsidy for vehicle purchase
VP = Average purchase price for a truck
PR = Percent replacement rate of active fleet per year
TF_{i} = Number of trucks in the transit fleet for country i
I = Standard existing interest rates for truck purchases
SI = Assumed subsidized interest rate for truck purchases

**Total Net Revenues for Truckers**

\[ NRT_{i} = TR_{i} + S_{i} - \sum_t (TC_{it} + DC_{it}) - IP_{i} \]

Where:
NRT_{i} = Total net revenues for truckers in country i
TR_{i} = Total revenues for truckers in country i
S_{i} = Government subsidy of the trucking industry for country i
DATA INPUTS AND ASSUMPTIONS

TC_{it} = Total operating costs for transit trucks from country i and operator type t
DC_{it} = Total operating costs for domestic trucks from country i and operator type t
IP_{i} = Informal payments made by truckers from country i

**Percent Change in Import Price Due to Reform**

\[ \Delta PP_{imn} = \sum_{n} (tr_{i1} - tr_{i0}) \times SP / UP_{in0} \]

Where:
- \( \Delta PP_{imn} \) = Change in import price for commodity n in country i
- \( tr_{i1} \) = Transit tariff per ton-km for country i in import direction after reform
- \( tr_{i0} \) = Transit tariff per ton-km for country i in import direction before reform
- \( SP \) = Percent of transport price change passed on by shippers to consumers or producers
- \( UP_{in0} \) = Unit price per ton-km for commodity n in country i before reform

**Percent Change in Export Price Due to Reform**

\[ \Delta PP_{ixn} = \sum_{n} (tr_{i1} - tr_{i0}) \times 0.9 \times SP / UP_{in0} \]

Where:
- \( \Delta PP_{ixn} \) = Change in export price for commodity n in country i
- \( tr_{i1} \) = Transit tariff per ton-km for country i in import direction after reform
- \( tr_{i0} \) = Transit tariff per ton-km for country i in import direction before reform
- \( SP \) = Percent of transport price change passed on by shippers to consumers or producers
- \( UP_{in0} \) = Unit price per ton-km for commodity n in country i before reform

**Volume of Imports Induced by Reform**

\[ \Delta IM_{i} = \sum_{n} B_{imn} \times \epsilon_{dn} \times \Delta PP_{imn} \]

Where:
- \( \Delta IM_{i} \) = Increase in imports for country i
- \( B_{imn} \) = Base demand for country i imports in tons per year for commodity group n
- \( \epsilon_{dn} \) = Elasticity of demand with respect to price for commodity group n
- \( \Delta PP_{imn} \) = Percent change in import price for commodity n in country i

**Volume of Exports Induced by Reform**

\[ \Delta EX_{i} = \sum_{n} B_{ixn} \times \epsilon_{sn} \times \Delta PP_{ixn} \]
Where:
\[ \Delta \text{EX}_i = \text{Increase in exports for country } i \]
\[ B_{imn} = \text{Base demand for country } i \text{ imports in tons per year for commodity group } n \]
\[ s_n = \text{Elasticity of supply with respect to price for commodity group } n \]
\[ \Delta \text{APP}_{ixn} = \text{Percent change in export price for commodity } n \text{ in country } i \]

**Savings for Coastal Country Shippers**

\[ SS_i = CD_i * 0.1 * dr_i * (1 - SP) \]

Where:
\[ SS_i = \text{Savings for shippers in country } i \]
\[ CD_i = \text{Demand for cabotage transport in ton-km carried by country } i \text{ truckers} \]
\[ dr_i = \text{Domestic freight tariff in country } i \]
\[ SP = \text{Percent of transport price change passed on by shippers to consumers or producers} \]

**Savings for Landlocked Country Shippers**

\[ SS_i = CD_i * 0.1 * dr_i * (1 - SP) + (tr_{i0} - tr_{i1}) * (1 - SP) * B_{im} * L_{im} + (tr_{i0} - tr_{i1}) \]
\[ * 0.9 * (1 - SP) * B_{tx} * L_{tx} \]

Where:
\[ SS_i = \text{Savings for shippers in country } i \]
\[ CD_i = \text{Demand for cabotage transport in ton-km carried by country } i \text{ truckers} \]
\[ dr_i = \text{Domestic freight tariff in country } i \]
\[ tr_{i1} = \text{Transit tariff per ton-km for country } i \text{ in import direction after reform} \]
\[ tr_{i0} = \text{Transit tariff per ton-km for country } i \text{ in import direction before reform} \]
\[ SP = \text{Percent of transport price change passed on by shippers to consumers or producers} \]
\[ B_{im} = \text{Base demand for country } i \text{ imports in tons per year} \]
\[ B_{ix} = \text{Base demand for country } i \text{ exports in tons per year} \]
\[ L_{im} = \text{Weighted average length of import corridors serving country } i \]
\[ L_{ix} = \text{Weighted average length of export corridors serving country } i \]

**Consumer Surplus (Net economic value of increased consumption in landlocked countries)**

\[ CS_i = \sum_n \Delta \text{APP}_{imn} * U_{im0} * \Delta IM_t * PC_m/2 \]

Where:
\[ CS_i = \text{Increase in consumer surplus for consumers in country } i \]
\( \Delta PP_{imn} = \text{Percent change in import price for commodity } n \text{ in country } i \)

\( UP_{in0} = \text{Unit price per ton-km for commodity } n \text{ in country } i \text{ before reform} \)

\( \Delta IM_i = \text{Increase in imports for country } i \)

\( PC_m = \text{Percent of imports that are consumer goods} \)

**Total Benefits to Consumers in Coastal Countries**

\[
CB_i = CD_i \times 0.1 \times dr_i \times SP \times PC_d
\]

Where:

\( CB_i = \text{Total benefits to consumers in country } i \)

\( CD_i = \text{Demand for cabotage transport in ton-km carried by country } i \text{ truckers} \)

\( dr_i = \text{Domestic freight tariff in country } i \)

\( SP = \text{Percent of transport price change passed on by shippers to consumers or producers} \)

\( PC_d = \text{Percent of domestic shipments that are consumer goods} \)

**Total Benefits to Consumers in Landlocked Countries**

\[
CB_i = (CD_i \times 0.1 \times dr_i \times PC_d + (tr_{i0} - tr_{i1}) \times B_{im} \times L_{im} \times PC_m) \times SP + CS_i
\]

Where:

\( CB_i = \text{Total benefits to consumers in country } i \)

\( CD_i = \text{Demand for cabotage transport in ton-km carried by country } i \text{ truckers} \)

\( dr_i = \text{Domestic freight tariff in country } i \)

\( PC_d = \text{Percent of domestic shipments that are consumer goods} \)

\( tr_{i1} = \text{Transit tariff per ton-km for country } i \text{ in import direction after reform} \)

\( tr_{i0} = \text{Transit tariff per ton-km for country } i \text{ in import direction before reform} \)

\( B_{im} = \text{Base demand for country } i \text{ imports in tons per year} \)

\( L_{im} = \text{Weighted average length of import corridors serving country } i \)

\( PC_m = \text{Percent of imports that are consumer goods} \)

\( SP = \text{Percent of transport price change passed on by shippers to consumers or producers} \)

**Producer Surplus (Net economic value of increased exports for producers in landlocked countries)**

\[
PS_i = \sum \Delta PP_{ixn} \times UP_{in} \times \Delta EX_i / 2
\]

Where:

\( PS_i = \text{Increase in producer surplus for exporters in country } i \)
ΔP_{inx} = \text{Percent change in export price for commodity } n \text{ in country } i

UP_{in} = \text{Unit price per ton-km for commodity } n \text{ in country } i \text{ before reform}

ΔEX_i = \text{Increase in exports for country } i

**Total Benefits to Producers in Landlocked Countries**

\[ PB_i = (tr_{i0} - tr_{i1}) \ast SP \ast (B_{im} \ast L_{im} \ast PI_{m} + 0.9 \ast B_{ix} \ast L_{ix}) + PS_i \]

Where:

PB_i = \text{Total benefits to producers in country } i

tr_{i1} = \text{Transit tariff per ton-km for country } i \text{ in import direction after reform}

tr_{i0} = \text{Transit tariff per ton-km for country } i \text{ in import direction before reform}

SP = \text{Percent of transport price change passed on by shippers to consumers or producers}

B_{im} = \text{Base demand for country } i \text{ imports in tons per year}

L_{im} = \text{Weighted average length of import corridors serving country } i

PI_{m} = \text{Percent of imports that are intermediate goods}

B_{ix} = \text{Base demand for country } i \text{ exports in tons per year}

L_{ix} = \text{Weighted average length of export corridors serving country } i

PS_i = \text{Increase in producer surplus for exporters in country } i

**Total Net Economic Benefits**

\[ NBE_i = NRT_i + SS_i + CB_i + PB_i \]

Where:

NBE_i = \text{Total net economic benefits for country } i

NRT_i = \text{Total net revenues for truckers in country } i

SS_i = \text{Savings for shippers in country } i

CB_i = \text{Total benefits to consumers in country } i

PB_i = \text{Total benefits to producers in country } i